AUGUST 1948

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Contact Aeration Sewage Treatment
Glendale Settles the Dust
Laying 4 Miles of 58" Pipe

Public Works Magazine

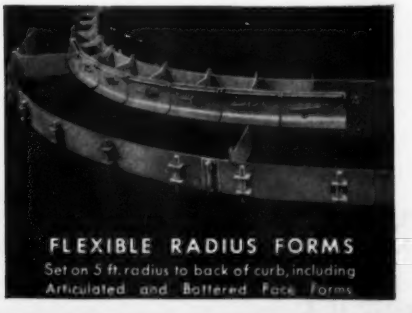
BLAW-KNOX STEEL FORMS
for HIGH DOLLAR RETURN VALUE

CONCRETE CURB AND GUTTER FORMS
With Common Type Face Form.

CONCRETE CURB

SIDEWALKS

CURB AND GUTTER



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Set on 5 ft. radius to back of curb, including Articulated and Battered Face Forms

Here's why—

Thousands of contractors are using Blaw-Knox Steel Forms, because they get a high dollar return on their investment. Whether the job is straight or battered curb, combined curb and gutter or sidewalk construction—it can be done quicker and cheaper with standard Blaw-Knox form set-ups.

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of BLAW-KNOX COMPANY
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Pittsburgh 22, Pa.

BLAW-KNOX CONSTRUCTION EQUIPMENT

The versatile cost-reducing Maintainer.

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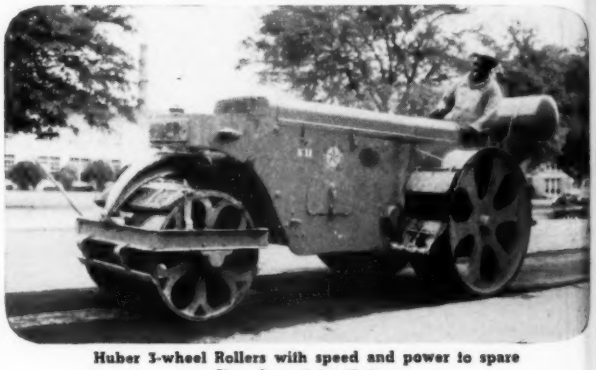
You can really step up the efficiency of road building operations with modern hard working Huber machinery. Huber road machinery is built to do your job . . . do it faster . . . better . . . and for less.

Huber machinery will permit you to employ real cost-saving methods. The extra reliability and added service life built into each piece of Huber equipment makes Huber machinery a foremost choice among road construction and maintenance men everywhere. Take your cue from this reputation for efficient low cost operation and at the same time realize a greater profit on your equipment investment. After a trial, and cost comparison you will see why Huber machinery produces more favorable results in all phases of road work under all conditions. Write today for descriptive bulletins and name of your nearest Huber dealer. He can help you save money.

Huber Variable Weight Tandem Rollers
Sizes from 3 to 14 tons.



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Sizes from 5 to 12 tons.

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HUBER

3 Wheel • Tandem

ROAD ROLLERS *and* MAINTAINERS

Precision Engineered for Long, Hard Service

15 Years of Service . . . Over 1700 Installations

THE COMMINUTOR

Is Specifically Designed to Screen and Cut Sewage Solids Under Water

From the Mediterranean to the Philippines; from the Arctic Circle to Australia, wherever there is modern sewage treatment, you will find Comminutors. Such world-wide acceptance is based on a machine that efficiently and effectively performs a service unmatched by any other type of equipment.

The Comminutor, compact, economical, silent, does away with the need for screens, rakes, grinders, burial pits and incinerators or other means of destroying the filth that is obtained by the old methods. With no screenings to stand in the open, there is no odor, no additional labor, and none of the unsightliness usually connected with screenings and their disposal.

The sturdy construction of the Comminutor is the result of long experience. The drum is a single casting, precision machined to close tolerances. Cutting bars, combs and teeth are firmly seated, yet easily removable for sharpening or replacement. They are staggered and distributed to effect multiple small shearing actions. This, plus inertia of the drum in motion, and gearing, allows use of small motors with consequent power economy. No housing is required for the Comminutor.

The Chicago Pump Company Comminutor is the result of many years of research and trial. "Bugs" in early models have long been eliminated so that the machines in use for many years have established an incomparable record of successful performance in the field.

If you have work in the sewage treatment field, write today for the Comminutor Bulletin which gives complete engineering data.

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• FLUSH-KLEENS • 'PAKAGE' PLANTS •
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Vol. 79 PUBLIC WORKS No. 8

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AUGUST, 1948

7,000,000 GALLONS OF OIL POURED— NEVER CHANGED SPRAY NOZZLE

SPEEDY, SMOOTH OPERATION— POSITIVE PRESSURE CONTROL

PROOF of efficiency and long life of the STANDARD STEEL Pressure Distributor is best reflected in the hard daily use to which it is put. "Never changed a spray nozzle—never a delay on the job—never a stop for repairs," are typical experiences of operators of this equipment. The full 24' circulating spray bar gives uniform application over the entire length of bar. Test runs—warm up periods are eliminated—so there is

Never a Delay
. . . . Every Job Finished on Time

ROY BAKER
OZAWKIE, KANSAS

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Standard Steel Works
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North Kansas City, Missouri

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We have now poured thru this machine over seven million gallons of oil including everything from NO to AC8 and AC9; and have never changed a spray nozzle, or anything else, except a few springs and gaskets in the spray bar.

Whenever you are down this way, be sure and drop by and see me.

Yours very truly,
Roy Baker
Roy Baker

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PRESSURE DISTRIBUTORS
STREET FLUSHERS
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TAR KETTLES
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Tests on Standard Steel Pressure Distributors prove that our equipment maintains absolute accuracy of pressure and absolute temperature uniformity over every inch of the 24 foot full circulating spray bar.

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NORTH KANSAS CITY, MO., U.S.A.

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PUBLIC WORKS Magazine

Edited by
W. A. HARDENBERGH and A. PRESCOTT FOLWELL

AUGUST, 1948

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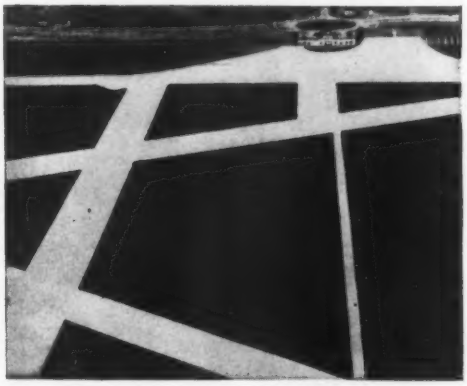
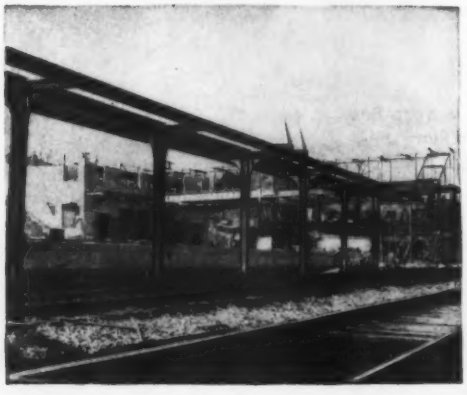
SOMETHING *New* IN UNDERDRAINAGE . . .

IMPROVED PERFORATED CLAY PIPE





This new and better Vitrified Clay Perforated Pipe — now included in A.S.T.M. Standards — was designed as a result of research conducted by the U. S. Engineer Corps, various state highway departments and the Clay Sewer Pipe Association. It is made *especially* for underdrains. The improved design features smaller holes, clean-cut and scientifically placed to handle more ground water, while reducing to a minimum entrance into the line of soil and backfill material. An unobstructed pipe invert is maintained which induces faster flow, more complete drainage.

For Better Drainage . . . Greater Savings Specify A.S.T.M. Perforated Clay Pipe

Improved Perforated Clay Pipe has structural and dimensional specifications identical with A.S.T.M. Designations C13 and C200 for non-perforated Standard and Extra-Strength Clay Pipe, with added requirements for perforations. It conforms to manufacturing standards of the entire Clay Pipe industry, allowing wide application of its special advantages. New Perforated Clay Pipe embodies all the lasting qualities of Vitrified Clay Pipe — strength, durability, and corrosion-resistance. It is the ideal drainage material on projects of every size and nature, both in private and public works. Its many brilliant performance records as a superior underdrainage material for highways, airports, railroads, factories, housing projects and roadways are swinging more and more engineers to this highly efficient drainage pipe.

If you need specific information on a Clay Pipe problem, write the details to the office nearest you.

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Vitrified
CLAY PIPE
CLAY PIPE NEVER WEARS OUT!

The Editor's Page

Better Equipment for the City-County Road Field

Our equipment manufacturers have done a remarkable job in devising and furnishing new types of better and more economical equipment for the big contractor. We do not think they have done so well for the man charged with city-county-township road and street maintenance and construction. What has been furnished has been built well, but newer and more effective types of equipment have for the most part been lacking.

This office is now engaged in a survey of the "particular piece or type of equipment found most useful in construction and/or maintenance." Information so far received has been from county engineers only. An interesting factor is the mention of many items not generally considered standard equipment; it surprised even the editor. We think that the engineers and superintendents responsible for building our roads and streets and for maintaining them are right now very receptive to new ideas in better and more economical equipment.

Retirement for Reserve Officers

Because a considerable proportion of our readers are reserve officers, we are particularly glad that the recent Congress passed a bill providing retirement for them. The provisions of this bill seem fair. It provides for retirement at age 60, after twenty years of service, of which at least four years must have been active duty and, in the case of men now holding reserve commissions, must have included service in either World War I or II. Retirement pay is based on the pay of the highest rank held, with 2½% per year for active duty and one-half per cent per year for reserve duty. Consideration for reserve officers has long been overdue. We hope that other provisions concerning reserve officers, including training, will be as sound and fair as the retirement system.

Creating Favorable Public Opinion

Engineers are notoriously slow to recognize the importance and value of public opinion, and as a rule neglect public relations work deplorably. For that reason we have applauded the excellent pioneer program of the American Water Works Association in this respect. Now the Cast Iron Pipe Research Association has prepared a booklet "Creating favorable public opinion for water supply systems" which is being sent out to water works superintendents, mayors, city managers, city engineers and consulting engineers. It presents interesting facts about public water supply; provides cartoon illustrations; and contains suggestions of value in the preparation of speeches, newspaper publicity and advertisements.

Highways, sewerage and refuse collection and disposal need favorable public opinion just as much as do other activities and obligations of our communities. The American Road Builders' Association has done some good work along this line, but more should be done. The Federation of Sewage Works Associations has an opportunity, as well, to popularize the frequently unpopular science of liquid waste disposal. Unfortunately there is no united group in the refuse collection and disposal field, unless it is the American Public Works Association; but that field of work needs publicity and favorable public opinion, and lots of it—also public education.

Engineering for the Army

In replying to a questionnaire sent jointly by engineering societies and governmental agencies, only one-third of the more than 3,000 civil engineers replying said they had been used in their primary specialty for the greater part of their time while in the service. Not even this nation can afford to waste so much of its technical talent. Major changes in the service engineering setup must be made, the more so that legislation passed in 1947 has set back service engineering, in our opinion, to about where it was fifty years ago. It is true that the effects of this legislation will not be immediately apparent, but the army engineers of ten years hence will demonstrate clearly what has happened—unless remedial steps are taken. Changes must include overall supervision for the five separate and distinct engineering services now established in National Defense; provision for utilizing the great reservoir of skills available among those who are not technically engineers; and a very thorough understanding by service engineers of civilian procedures and methods, so that adaptation to military needs will be quicker and more effective than it has been in the past.

Making Airports Pay

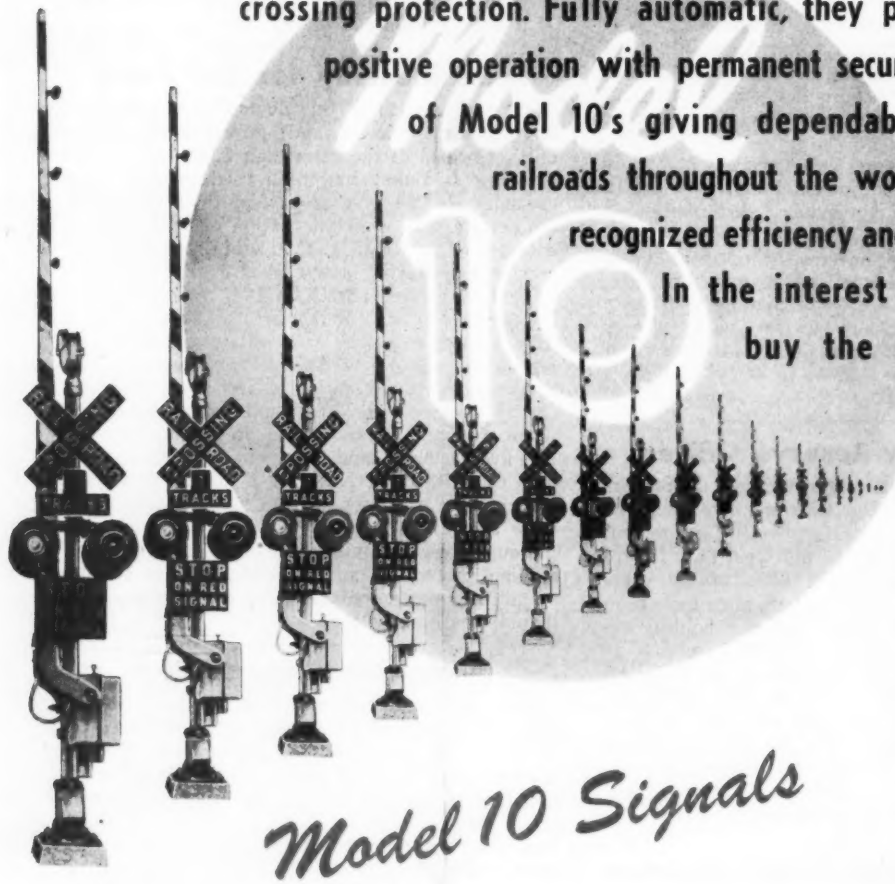
Not many of our municipal airports are self-supporting, in the narrow sense of the term. Whether or not an airport can be made to pay for itself depends a good deal on local conditions. It is exceedingly doubtful if charges from aviation operation can be made great enough to carry the burden. If landing fees, hangar and space rentals, repair shop concessions and taxes or profits on fuel are relied on solely, few airlines could afford to use the field commercially. The other resource available for making the airport pay its own way is by the development of revenue from other than aviation activities What these activities might include depends also on local conditions, and prevents a challenge to airport management authorities to use imagination and initiative.

Putting the Pressure on the Editor

We have been having a good time saying just about what we thought on this page, without pulling too many punches. Now up jumps a readership survey which shows that some 70% of all those who replied read the editorials regularly, and only about 7% don't read them at all. Perhaps we should reform, with so many folks checking up on us, and concentrate on more pious subjects; but we fear we have been speaking our mind too long for such change. So, despite this new pressure on the editor, we'll still say what we think.

Best Buy in Safety

Model 10 Signals are today's best buy in railroad-highway grade crossing protection. Fully automatic, they provide continuous, positive operation with permanent security. The thousands of Model 10's giving dependable service on 80 railroads throughout the world are PROOF of recognized efficiency and practical economy. In the interest of public safety, buy the best . . . . buy



Model 10 Signals

- Operate on the closed circuit principle.
- Operate regardless of weather or temperature conditions.
- Effectively safeguard against "second train" accidents.
- Block traffic in approach lanes only.

TIME-TESTED Model 10's

Eleven years of service—and NOT ONE FATALITY has ever occurred as a result of operation failure on the part of Models 10's.

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When your job demands a multi-stage pump, the Fairbanks-Morse pump expert will recommend the right one from among the broad line built by *his* company . . .

But—frequently he can help you save the cost of a more expensive unit by recommending one of these single-stage, split-case pumps . . . whose performance, where heads reach toward 300 feet and capacities range to 72,000 g.p.h., is often equal to that of more costly multi-stage pumps.

Without prejudice, he can find for you the pump that suits your needs best; for in the Fairbanks-Morse line, he has all types, all sizes.

When it comes to pumps...

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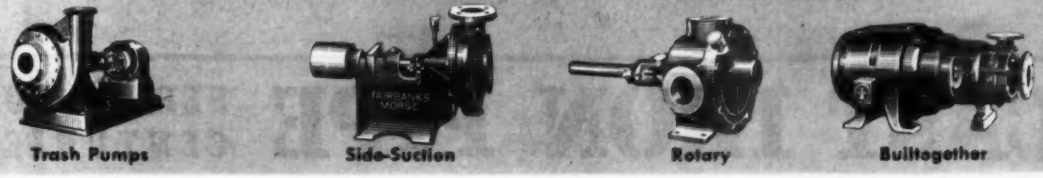
A FEW OF THE COMPLETE LINE OF FAIRBANKS-MORSE PUMPS



When you need special information—consult the READERS' SERVICE DEPT. *on pages 77-81*

96%

ARE STILL IN SERVICE

Of all the CAST IRON WATER MAINS ever laid in these 25 cities since 1817 in sizes 6-inch and larger 96% ARE STILL IN SERVICE

We are stating a fact and you don't have to take our word for it. We refer you to one of the most important fact-finding jobs ever undertaken by the water works industry—the recently completed survey of the service life of water works facilities. This survey was sponsored by three water works associations.

The survey shows that *96%* of all the cast iron water mains ever laid by 25 representative cities in sizes 6-inch and larger *are still in service.*

These cities had laid 50 million feet—nearly 9500 miles—of 6-inch and larger cast iron water mains since 1817. They were selected by the Joint Committee, which directed the survey, as representing a cross-section of water service conditions throughout North America.

A detailed report of the survey has recently been published by the American Water Works Association. We have reprinted, by permission, the facts pertaining to cast iron water mains in a brochure which will be sent on request. Write to Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 122 South Michigan Ave., Chicago 3, Ill.

Alexandria, Virginia
Babylon, New York
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Clyde, New York
Denver, Colorado
Des Moines, Iowa
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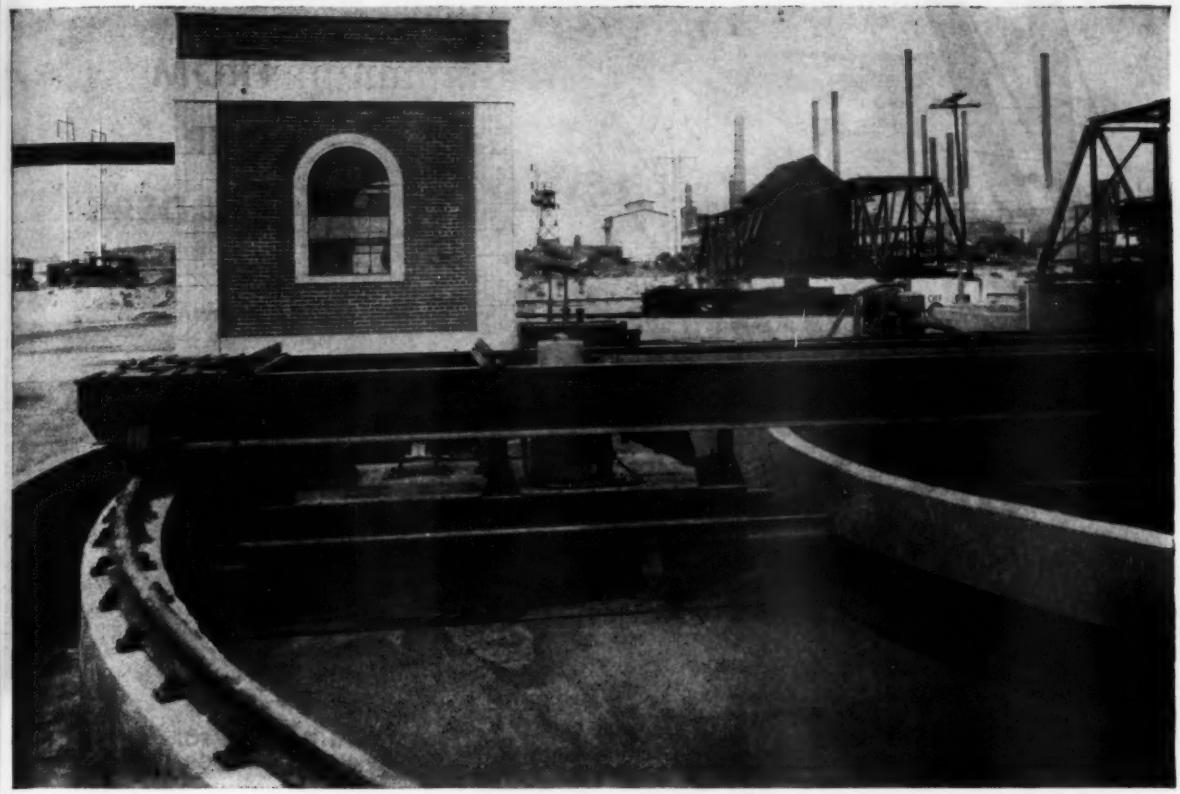
Utica, New York
West Palm Beach, Florida
Winnipeg, Manitoba

CAST IRON PIPE SERVES FOR CENTURIES

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-81*



Magnetite Filter, built by Filtration Equipment Corporation, New York City, operating in an Eastern sewage treatment plant. Everdur Alloys used for cleaner housing, leveling blades, reinforcement bars and assembly bolts and nuts.

Where Industrial Wastes Complicate Corrosion Problems

CONSIDER EVERDUR*

EVERDUR COPPER-SILICON ALLOYS, noted for their versatility in sewage treatment equipment, are especially indicated where industrial wastes are mixed with domestic sewage.

Such combination systems present a problem of increased corrosion, with corroding elements that are variable in both character and intensity. The rustproof and highly corrosion resistant qualities of Everdur Alloys usually can be used to advantage under these conditions.

Everdur has been used in the sewage field since 1927 and has given satisfactory service in a wide variety of installations. Because of their high strength, durability and good fabricating qualities, Everdur Alloys lend themselves to the economical construction of wrought assemblies that are light in weight and easy to operate. For detailed information, write for Publications E-11 and E-5.

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

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For several years, despite record production, it has been impossible for us to keep up with the rapidly increasing demand for more and more Briggs & Stratton gasoline engines. Now, however, more equipment and appliances than ever before are being powered with Briggs & Stratton engines.

Many models are now available for replacement or auxiliary power. See them on display at your nearest Briggs & Stratton Authorized Service Station or dealer.

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wis., U. S. A.

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-81*

FROM OUR READERS

FROM OKINAWA:

Dear Sir: Presently I am in urgent need of all three of your PUBLIC WORKS Manuals (Highway, Water Works and Sewerage). I am preparing to set up a rather extensive construction program and in many cases will be called upon to work out detailed designs for such projects as water systems, sewage disposal, housing and airfields.

FRANK W. ROBERTS

(Ed. Note: The Manuals, the Trickling Filter Handbook and selected issues of PUBLIC WORKS containing the articles on Small Sewage Treatment Plants, designing water distribution systems, etc., have been sent.)

ANTI-FREEZE FOR HANGAR DOORS:

Dear Sir: We read the issues of your magazine "Public Works" with a great deal of interest and your article entitled "Melting Snow at the Chicago Airport," as mentioned on page 81 of the April 1948 issue, mentions what is believed to be the first snow melting system for an Airport—that in connection with the hangar at the Chicago Airport.

You will be interested to know that while the particular type of installation may be among the first of that type, nevertheless, the circulation of a heated anti-freeze to remove ice and snow at hangar doors was used by this office in 1940.

At that time we had the commission to design a hangar for the City and County of Denver which was subsequently operated by United and Continental Airlines. As construction costs had to be kept within the minimum to stay within the bond issue, sliding doors were used in place of canopy or vertical sliding doors. To overcome objections to the accumulation of ice and snow making the operation of the doors difficult, we designed a door installation wherein the tracks were of heavy tubular sections. The various lengths of the tubular rail were welded together with a header at the end joining the several rails thus permitting circulation of a heated anti-freeze through the rail itself. This method served the two-fold purpose of keeping ice and snow from accumulating on the rails and directly adjacent thereto. The hangar doors in question covered a clear span opening of 210′. As the doors on each side of the center were three section units, three rails were required. The doors with the special wheel

for the curve rail were designed and furnished by Truscon.

The system of circulating an anti-freeze through a tubular section or combination thereof for the rail was patented and during the war the design was turned over to the government and we also included the installation in connection with a number of typical hangars we designed for the Navy Department. As the construction of the Army and Navy hangars was not followed through by this office we do not know to what extent the system was used.

S. MARSTON,
Executive Vice President
Albert Kahn Associated Architects & Engineers, Inc., Detroit, Mich.

FROM A STUDENT:

Dear Sir: I am a subscriber to your magazine and a senior civil engineering student at the University of Wisconsin, as well as a part-time employee with a firm here. Within a few months I will graduate into the unlimited opportunities of the engineering field, and to my regret find myself without modern, up-to-date information about equipment and practical methods in my field. It is with this in mind that I request one copy of each of the catalogs listed herewith. These will not only help me in my last few months in college, but will be of great assistance to me in the future.

ARTHUR R. MORAN

(Ed. Note: We have sent also the Highway Manual, the Water Works Manual, the Sewerage Manual, the Trickling Filter Handbook, and selected other material. It is a pleasure to help our young engineers get started.)

Swimming Pool Operation

This is one of the best booklets on swimming pools and their operation that we have seen. It was prepared by the Division of Sanitary Engineering of Illinois, of which C. W. Klassen is Chief Sanitary Engineer and Jack Sieg is Senior Sanitary Engineer. The 72 pages contain detailed information on: (1) the bathhouse; (2) the water treatment plant; (3) the pool area; and (4) miscellaneous, such as off-season protection, pool classification, wading pools, bathing beaches, operation check list, etc. We believe that you can get a copy from Mr. Klassen by addressing him at Springfield, Ill.

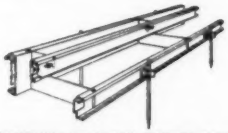
German Motor Roads

The German motor road system is unique in being the only modern road network built on a national scale. This report, prepared by British engineers, describes the condition of the German roads and the features of design, with criticisms and suggestions. For sale by the British Information Services, 30 Rockefeller Plaza, N.Y., at 55 cents postpaid.

"QUIT WORRYING ABOUT SPECIFICATIONS"

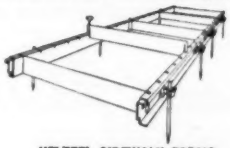
CURB FORMS

Sections 10' long—either straight or battered face construction. Steel forms for all special concrete curbs.



COMBINED CURB AND GUTTER FORMS

Each 10' section consists of 1 back curb form, 1 front gutter form and 1 face curb form, also 2 face curb form supports, 2 round stakes for back form and 2 round stakes for gutter form.



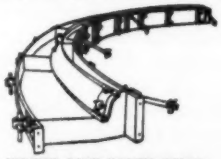
HELTZEL SIDEWALK FORMS

10' sections, slotted every 12" for division plates, which are removed without disturbing side forms after concrete takes its initial set.

HELTZEL

IS THE ANSWER

● Thirty-six years of concentrated engineering on concrete construction is at your disposal when you deal with Heltzel. As a result, the chances are, that what you may regard as a special problem is standard with Heltzel engineers. Illustrated here are a few of the basic Heltzel steel forms—many variations are at your disposal.



HELTZEL RIGID RADIUS FORMS

For building concrete curbs or curb and gutters when all intersections or corners must match. Heltzel forms made in sets to form a specified radius.

HELTZEL FLEXIBLE FORMS

Used when building radius curbs, curbs and gutters or sidewalks where the radius is subject to frequent change or for serpentine work in park areas.

CONCENTRATED *Engineering* IN CONCRETE CONSTRUCTION

Heltzel Steel Form & Iron Company, Warren, Ohio

Send me the following:

[ ] B-19 Steel Highway and Airport Forms
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[ ] A-20 Steel Forms for Curbs or Curb and Gutters or Sidewalks.

Name_____

Address_____

City_____ State_____

(Type of construction usually engaged in)

Heltzel
BUILDS IT BETTER

BINS, Portable and Stationary
CEMENT BINS, Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale
ROAD FORMS (with tie rod and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
SIDEWALK FORMS
CONCRETE BUCKETS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROAD

HELTZEL STEEL FORM & IRON CO
WARREN, OHIO · U. S. A.

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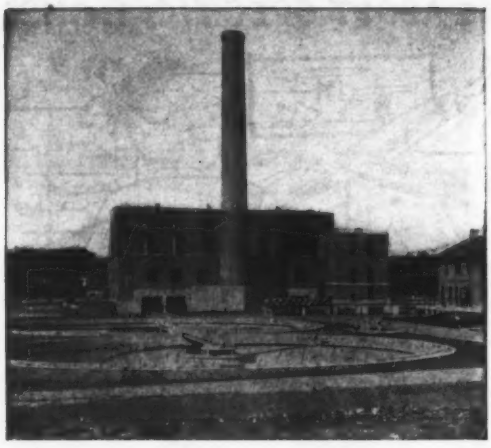
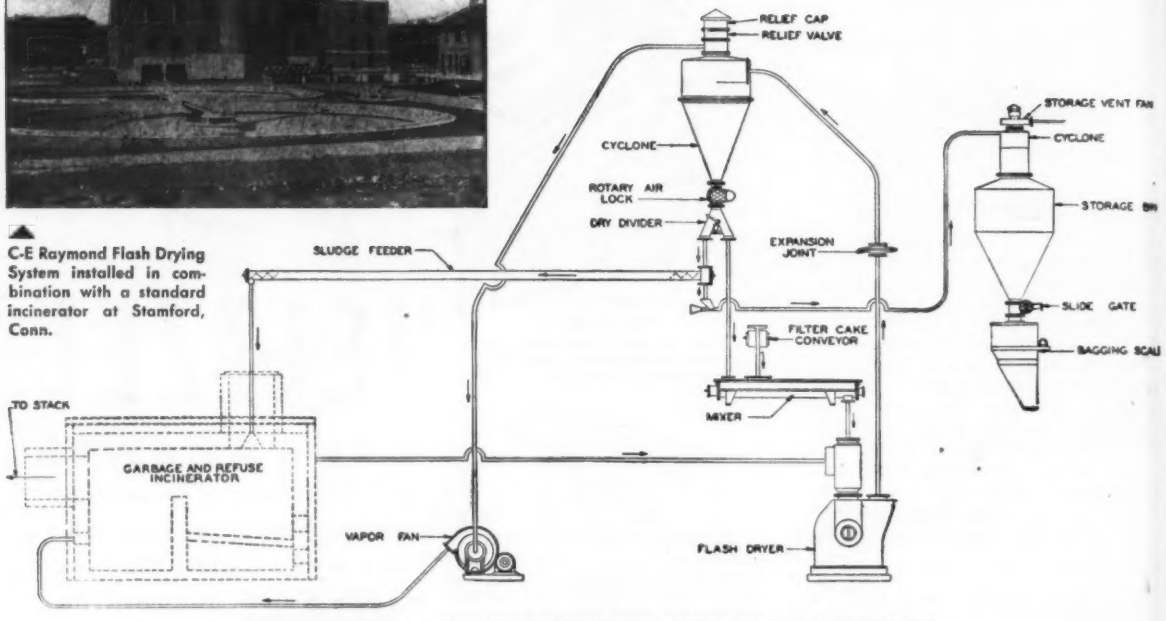


C-E Raymond Flash Drying System installed in combination with a standard incinerator at Stamford, Conn.

SIMPLIFY

the municipal waste disposal problem



FLOWSHEET SHOWING SLUDGE DRYING COMBINED WITH GARBAGE AND REFUSE INCINERATION

with the C-E Raymond Flash Drying System

A C-E Raymond Flash Drying System, installed in combination with a standard garbage and refuse incinerator, will dispose of *all* municipal wastes. Flash drying of sewage sludge is effected in the C-E Raymond System, while garbage and refuse are conventionally burned in the standard incinerator. Simple, clean and economical disposal . . . at one site.

Fertilizer a Plus Benefit End product of the C-E Raymond System is a valuable fertilizer or humus for municipal park use or profitable sale.

Operating Flexibility Should fertilizer supply temporarily exceed demand, excess dried sludge can be burned in refuse incinerator.

Maximum Use of Heat Waste heat from the incinerator is used for drying in the C-E Raymond System, permitting all digester gas to be utilized for power generation.

Moderate Capital Investment Utilization of incinerator heat in the C-E Raymond System eliminates the need for a separate furnace and reduces first cost.

All inquiries on the C-E Raymond System should be directed to the nearest office of The Dorr Company, world sales representatives in the Sanitary Engineering Field.

In sewage treatment... there's a Dorr unit for practically every step in every flowsheet

DORRCO

THE DORR COMPANY, ENGINEERS
570 LEXINGTON AVE., NEW YORK 22, N. Y.
ATLANTA • TORONTO • CHICAGO
DENVER • LOS ANGELES
RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.
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PETREE & DORR DIVISION, NEW YORK 22, N. Y.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

RESEARCH ENGINEERING EQUIPMENT

DORR

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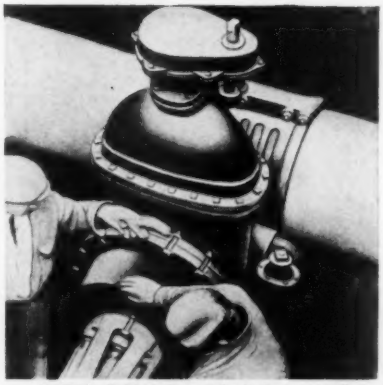
Engineering Facts about
Johns-Manville TRANSITE PRESSURE PIPE
Making Large Service Connections

READY adaptability to standard waterworks practice is an advantage of Transite* Pressure Pipe which is of special importance when making large service connections. Thousands of such connections are in service today, installed in Transite supply and distribution lines with standard equipment and tools under a variety of installation and working conditions.

For tapping the line under pressure, conventional tapping sleeves, tapping valves and drilling machines are generally used. The sleeves are first leaded and caulked in the usual manner. Sleeves to fit all sizes of Transite Pressure Pipe are available from several manufacturers. Tough and strong, the pipe wall is, nevertheless, readily drilled; Transite's unusual machinability assures a clean cut.

In cases where the line can be temporarily removed from service, a commonly used method of providing large connections is to insert into the line a fitting† such as a tee having the required outlet size. To do this, a section of pipe is first removed from the line. The Simplex Coupling permits quick removal and with a minimum of trench excavation. Two stubs of pipe are then cut from this section and inserted into the bells of the fitting to form an assembly of equivalent length to that of the section removed. No problem arises in joining stub ends and fitting, since lead or compound joints are readily made with Transite. Replacement of the assembly in the line is easily and quickly made with the standard Simplex Couplings.

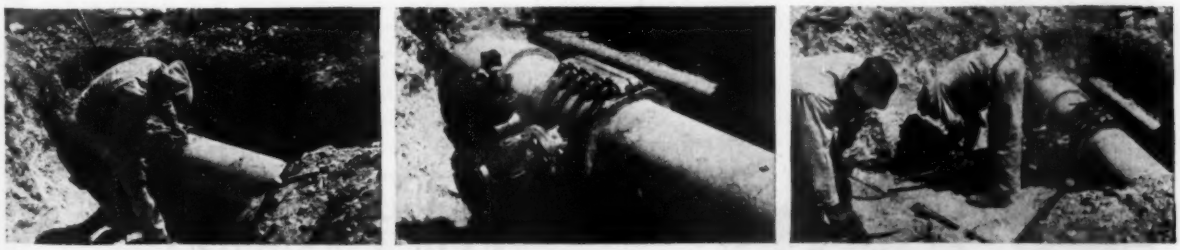


A 24-inch Transite main being tapped under full working pressure for a 20-inch branch connection.

A method sometimes used for making connections when the line is under pressure is the use of service clamps of the type equipped with double straps. These may be used for making service connections larger than those recommended for corporation stops inserted directly into the wall of the pipe or where multiple corporation stops are not used. After the service clamp and corporation stop are attached, the pipe wall is drilled with conventional drilling tools. Service clamps are not used for outlets exceeding one-quarter the diameter of the street main, nor larger than 4".

A previous advertisement in this series discussed tapping Transite Pressure Pipe for small service connections. A reprint is available on request. Address Johns-Manville, Box 290, New York 16, N. Y.

†The run of the fitting should have bell ends. Enlarged bells are used for class 150 pipe over 8" in diameter.



Conventional methods are used for making large service connections in Transite lines. Here are shown a tapping sleeve and valve being installed on a 12" line under pressure for a 4" outlet.

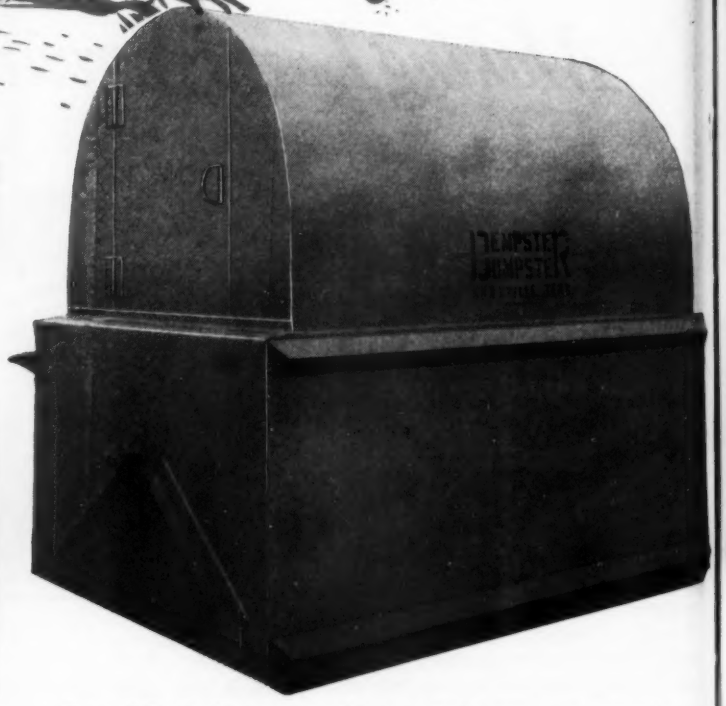
JOHNS-MANVILLE JM PRODUCTS

*Transite is a registered Johns-Manville Trade Mark

When you need special information—consult the READERS' SERVICE DEPT. *on pages 77-81*

OPEN REFUSE FEEDS THIS Disease Carrier!

Protection from Disease Carriers Is a Major Advantage of the Dempster-Dumpster System of Bulk Rubbish Collection



Rats and flies feeding on open refuse are a health menace no progressive city can endure. That's why, in more and more cities, the sanitary Dempster-Dumpster system of bulk rubbish collection is being installed. Many depositories, which are actually large detachable truck bodies, are placed at convenient locations in business districts, housing sections, apartments and schools, in fact, everywhere that the volume of rubbish would constitute a major sanitation problem if left uncovered. Once the rubbish is placed inside and the convenient door closed, no rats or flies can contaminate it . . . no wind can scatter it.

Another great advantage of the Dempster-Dumpster System is the simple, low-cost manner in which the rubbish is collected. The Dempster-Dumpster Truck Hoisting Unit makes scheduled rounds, picks up each full body in turn, hauls it, dumps it and returns the empty to its original location. Shown at left are the three simple steps in handling a body. Top, truck hoisting unit prepares to pick up loaded body. Center, body in carrying position. Bottom, body is automatically dumped. One man, the driver, handles the entire operation from hydraulic controls in the cab. Help your city to cleaner, more efficient bulk rubbish collection by writing today for complete information.

DEMPSTER DUMPSTER
TRADE MARK REG.

DEMPSTER BROTHERS, Inc.

988 DEMPSTER BLDG. KNOXVILLE 17, TENN.

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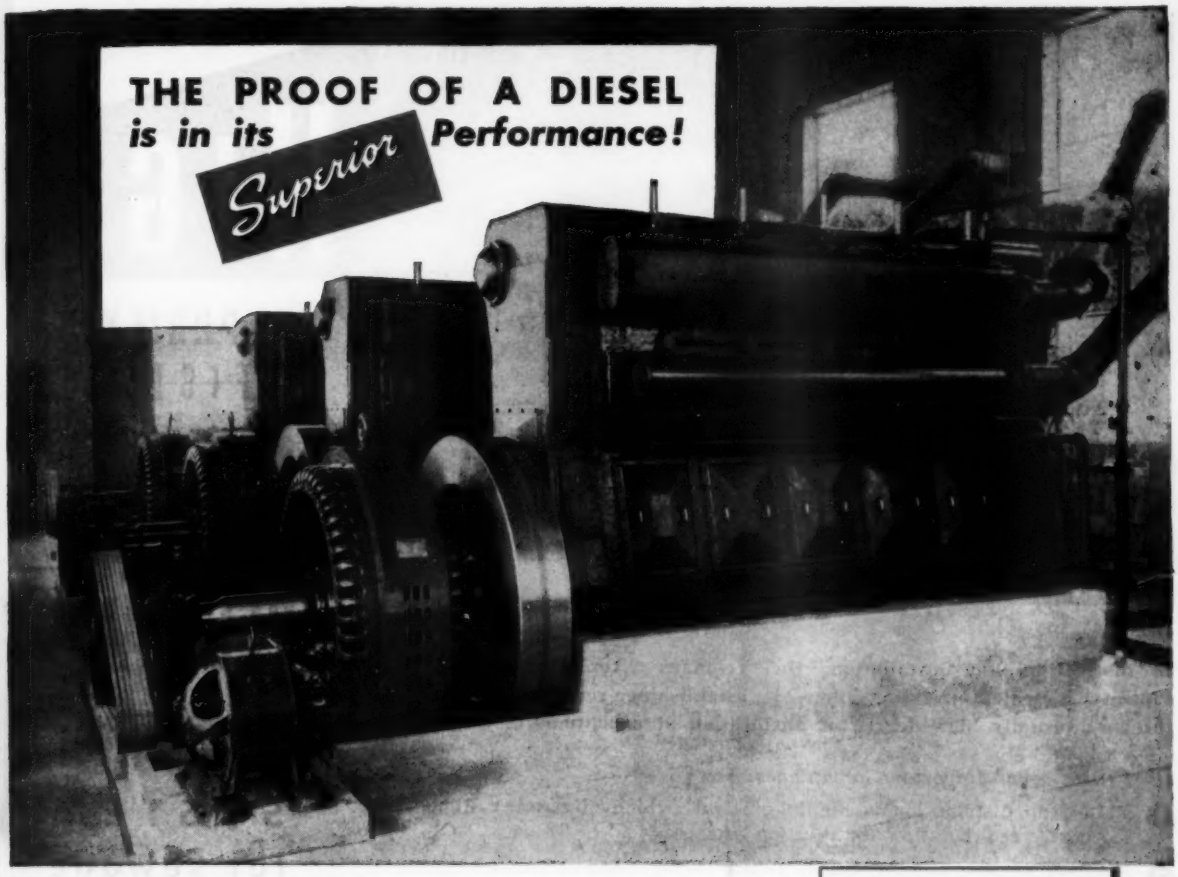
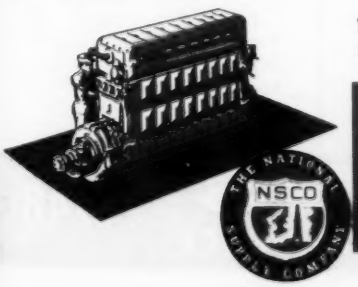


THIS municipal power plant in a Texas town offers convincing proof that Superior Diesels provide complete satisfaction. Originally this plant had three 350 hp. Superior Diesels. On the basis of the performance of these engines, a fourth Superior was purchased one year later; a fifth, six years later; and the sixth, a dual fuel, non-supercharged 720 hp. Superior was added just recently.

Again and again, Superior's on-the-job performance has resulted in repeat orders. These big, husky engines are used for water supply systems, sewage disposal plants, airport lighting and for many other vital municipal services.

Superior Diesels are made in supercharged and non-supercharged models that range from 170 to 1500 horsepower. One of our field engineers will be glad to point out the advantages these engines have for your community.

SUPERIOR ENGINE DIVISION OF
THE NATIONAL SUPPLY COMPANY
Plant and General Sales Office: Springfield, Ohio



Superior DIESEL

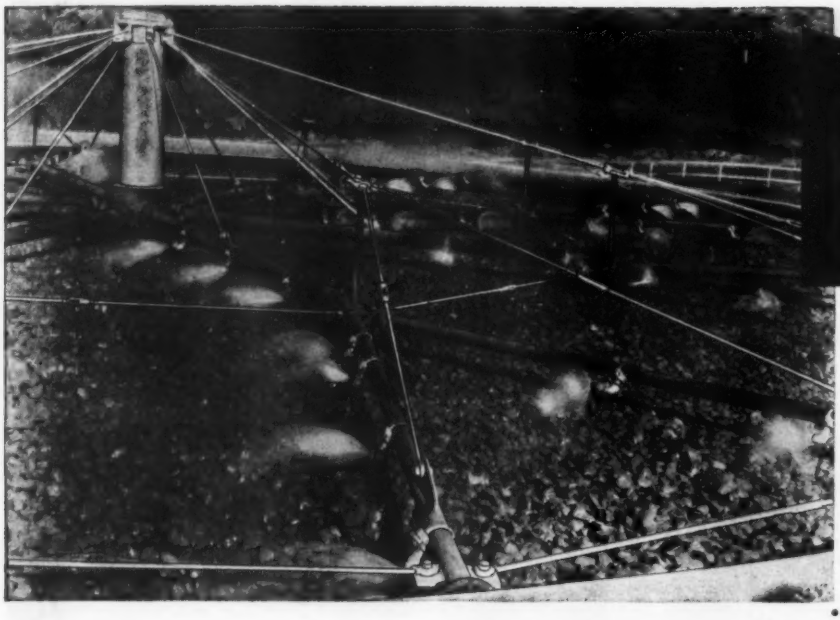
Another Superior Feature

JUST PRESS A BUTTON TO BURN YOUR CHOICE OF FUEL

Superior is the first and only Dual-Fuel Engine with push-button control that permits you to switch from oil to gas; or gas to oil instantly—with the flick of a finger.

Only Superior Diesel Engines Give You Superior Features

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-81*



HIGH

IN PURIFYING EFFICIENCY

LOW IN COST

YEOMANS "Aero-Filter" SYSTEM for sewage and waste treatment

In more than 100 installations the Yeomans "Aero-Filter," a high capacity biological trickling filter, is establishing remarkable records for an unusually high degree of purification at exceptionally low cost.

Note these seven important advantages:

1. Rain-drop distribution is highly efficient, which eliminates all need for costly recirculation for dilution purposes.
2. Single-stage operation produces a clear effluent; and reductions of raw sewage BOD ranging from 80% to 85% are common.
3. Two-stage operation is regularly obtaining reductions of raw sewage BOD ranging from 90% to 94%.
4. Construction cost is remarkably low, since the Aero-Filter bed is about one-eighth the size of a standard rate filter bed for equal capacities.
5. Operating cost is the lowest of all types of complete sewage treatment—no additional pumps, motors, tanks, etc., for recirculation.
6. Uninterrupted and almost complete momentary bed coverage minimizes troubles from odors, freezing, ponding and filter flies.
7. All returns are made direct to the filter—therefore an oversize primary tank to accommodate recirculation is unnecessary.

The "Aero-Filter" can be fitted to any requirements, from small units up to large treatment works. Accurate cost estimates and complete engineering data are readily obtainable — simply write us.

For treating industrial waste, the Aero-Filter has proved ideal—

HIGH LOADING
Especially important in treating exceedingly strong waste.

ECONOMY OF SPACE
The filtration bed is much smaller than in other types of treatment plant.

LOW COST
Economical to install, costs much less to operate — owing largely to absence of recirculation for dilution.

YEOMANS BROTHERS COMPANY

1423 NORTH DAYTON ST.
CHICAGO 22, ILLINOIS

For the handling and treatment of domestic sewage and industrial waste, Yeomans manufactures: Yeomans Aero-Filter—high capacity trickling filter • Yeomans "Package" Aerifier—activated sludge process • Rectangular and circular Sludge Collectors • Digesters • Centrifugal and pneumatic Sewage Ejectors • Scum, Grease and Sludge pneumatic Ejectors • Rotary Distributors • Plunger Sludge Pumps.

1898 **YEOMANS** 1948
50 YEARS OF PUMP EXPERIENCE

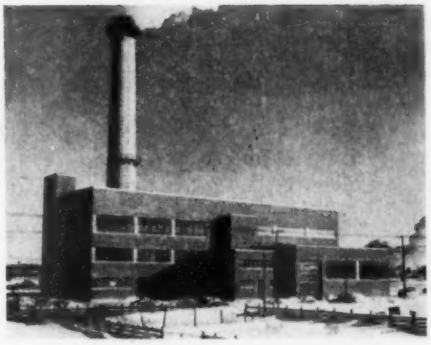
When you need special information—consult the READERS' SERVICE DEPT. on pages 77-81

PUBLIC WORKS MAGAZINE . . . August, 1948

VOL. 79. NO. 8

Winnipeg's New Incinerator Passes Its Tests

Photographs courtesy M. J. Sym, Winnipeg



The new Winnipeg incinerator.

INCINERATION has been utilized by Winnipeg, Man., for refuse disposal since 1910. However, as the city grew, the two original destructors were no longer able to handle the volume of wastes produced, and open dumps were employed for the surplus, with resulting nuisance and complaints. In 1944, W. D. Hurst, city engineer, in a report to the Council, recommended the construction of a new incinerator. While the existing units could have been modernized, it was considered more satisfactory and economical to construct a single new unit at a central site.

In accordance with this recommendation, Greeley and Hansen of Chicago were engaged as consulting engineers. Plans were prepared for a plant estimated to cost $550,000 and bonds were voted for this sum. The plant was designed to handle 500 lbs. per person per year of combustible mixed garbage and refuse from a population of 320,000, with a maximum monthly rate 150% of the average. The present population of Winnipeg and immediately adjacent municipalities is 289,000.

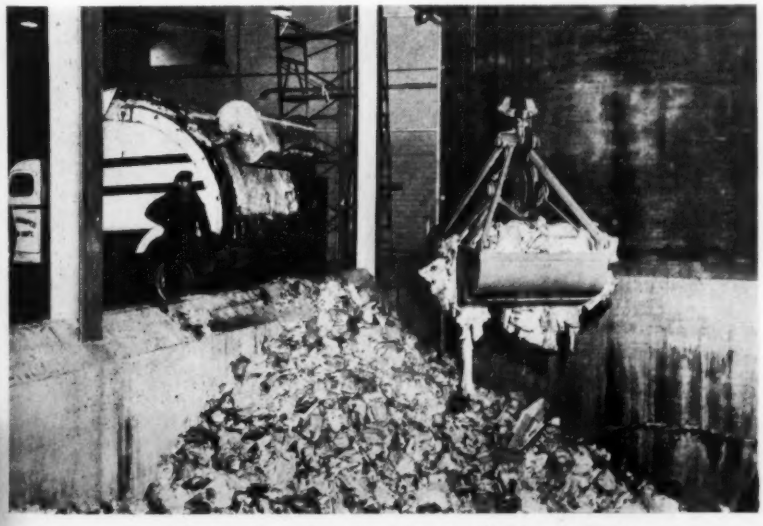
Designing the Plant

The plans provided for three furnace units, each with a capacity of 100 tons of combustible rubbish in 24 hours, installed in a building large enough for four such units; and with a chimney capable of handling four units of 100 tons capacity per 24 hours each. Alternates permitted either manually stoked square furnaces of conventional design, or mechanically stoked circular furnaces. The specifications were based on a garbage-refuse mixture with a moisture content of not more than 55% by weight and a heating value of not less than 7,000 btu per pound of dry solids. Included in the specifications were detailed provisions covering the building and the furnace appurtenances.

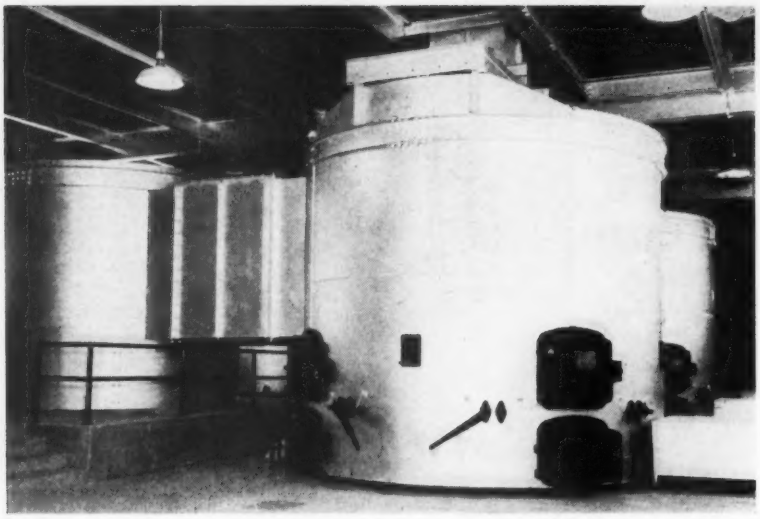
It was required that the bidder guarantee (1) the number of men required on each shift for the operation of the incinerator; (2) the kwh of electricity required for operation per ton of refuse consumed; (3) the average amount of coal required for each ton of refuse; (4) that each unit of the plant would incinerate 100 tons of the refuse per 24 hours; (5) that the furnace temperature would not fall below 1100°F for more than five minutes in any one hour during operation; and (6) that there would be no nuisance and no smoke denser than the No. 1 Ringelman scale. Provision was also made for evaluating the bids on the bases of both first cost and operating costs.

The bids received in June, 1945, were approximately $100,000 over the amount of money available. New bids were called in February, 1946, but the lowest bid received totalled $651,750. The city was then authorized to expend the additional necessary amount and the contract was awarded in March, 1946. The furnaces were to be Nichols Monohearth, mechanically stoked, furnished by Francis Hankin & Co., Ltd., of Toronto, and designed by Nichols Eng. & Research Corp. The chimney, built by Alphonse Custodis Chimney Co., Ltd., has an inside diameter of 12 ft. 6 ins., and a height of 175 ft. Work was begun in June, 1946, and the plant went into operation in 1947.

Tests on the plant were made in January and February 1948, by S. M. Clarke and O. C. Boyd of Greeley and Hansen. During the tests,



Clam-Shell takes refuse from bin for feeding furnaces.



Stoking floor view of the circular furnaces.

the plant was operated by the regular personnel with the addition of 1 man to record test data; 2 men on the charging floor to assist in sampling and charging; and 1 man on the ash floor. During the 4-week test period, records were kept of the amount of refuse burned, the hours of operation, and the number of charges to each furnace. Pyrometer charts were maintained after the pyrometer was installed on Feb. 2, and electric use records after Feb. 4 when a watt-hour meter was put into service.

Six-hour tests were made of the three furnaces individually, and of all three furnaces together. On one test, No. 2 furnace failed to maintain the guaranteed temperature, and was later retested and passed. The initial failure was determined to be due to the unusually high proportion of cans and bottles in the refuse at the time of the first test; and possibly also, in part, to the use of frozen garbage, for which allowance had to be made.

Measurement of Refuse for Tests

For each of the tests on the single furnaces, the refuse to be used was weighed in the trucks and segregated at one end of the storage bin. Approximately 25 tons were used for each test. This was accumulated from the last two deliveries each day. The refuse comprised a mixed collection of wrapped garbage, combustible rubbish, cans and bottles. For the test on the three furnaces together, it was not feasible to segregate a sufficient quantity of refuse and the weight incinerated during the test period was computed from the total weight during the day, in proportion to the number of charges.

The tests on the individual furnaces were started after 4 p.m. when all refuse deliveries for the day had been completed. The furnace to be tested had been brought to operating temperature, burned down and thoroughly cleaned. The first charge of segregated refuse was then introduced and this was taken as the time of the start of the test. The furnaces under test were operated at as high rates as possible with the type of refuse burned. Rates of operation were limited chiefly by the rapid accumulation of cans in the furnace, which necessitated frequent clean-outs. The stoking mechanisms were operated intermittently, as needed, throughout the duration of the testing period. The cone fans were operated 61% of the time and the ash pit fans 34%. It was neecssary at times to open the small stoking doors to keep the combustion chamber temperatures below 1900°F. Little hand stoking was required, except when cleaning out, which generally required about 20 minutes for each furnace. Ash was quenched and removed from the ash hoppers each time a furnace was cleaned.

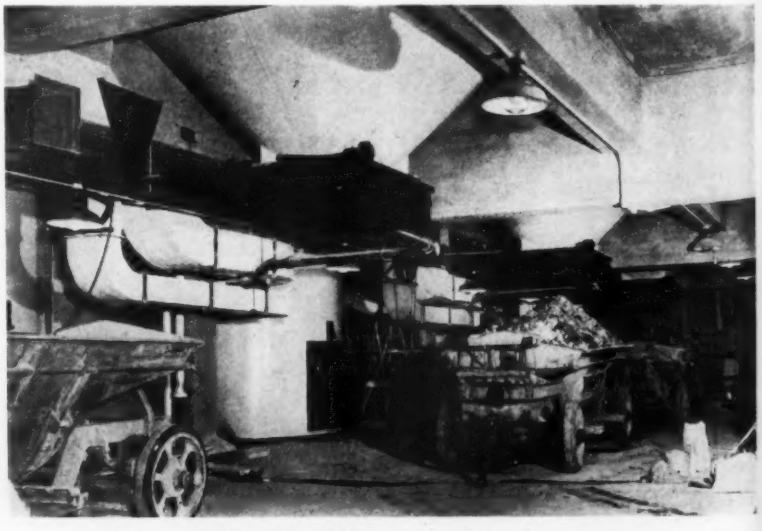
Sampling the Refuse

Samples of the refuse were obtained for analysis during each 6-hour test. Several shovels of refuse were taken from each of a number of charges, using care to make these samples as nearly representative as possible. The samples were accumulated in a box and at the end of the test were mixed and quartered. One quarter was well broken up and the cans and bottles removed and weighed separately; it was then remixed and again divided to provide the final 5-gal. sample for analysis. Samples were kept frozen until sent to the laboratory. Cans and bottles amounted to more than 15% of the weight of 52 samples. Ash was sampled by taking two or three shovels from each load removed from the furnace, but after some of the tests, the ash remaining in the furnace was dumped onto the ash floor and the cans and glass separated and weighed to determine their proportions.

Results of Tests

During the four-week test period, the plant burned 2060 tons in 22 operating days, or an average of nearly 100 tons per day. Power consumed per ton of refuse incinerated during the four weeks with the plant operating under capacity averaged

(Continued on page 24)



Ash removal floor and ash trucks.

The Cliff Lake pump station, interior and exterior views, Flin Flon, Man.

Water Works and Sewerage in the Far North

Unusual Distribution System at Flin Flon

M. A. Roche, Assistant to the General Manager, Hudson Bay Mining & Smelting Co.

THE Hudson Bay Mining & Smelting Co. operates a plant located at the town of Flin Flon, Manitoba, where low temperatures present difficulties not experienced in more temperate climates. On the average, the mean temperature is below 32° from October 22nd to April 12th, and below zero from December 8th to February 13th. The following data from the records kept during the past six years give an idea of the severity of our winter temperatures:

	Dec. 1933	*Jan. 1937*	*Feb. 1936*
Maximum	+ 7	+12	+24
Minimum	—46	—41	—46
Average maximum	—14	— 9	— 8
Average minimum	—26	—27	—25

Permanent frost exists in a zone of varying thickness, with the upper limit about 1 foot below the surface and the lower limit about 16 feet.

Water both for the company's plant and for the town is provided by the company, which pumps it from Cliff Lake through 13,172 ft. of 20" wood-stave pipe to a reservoir. Water for the plant and the town is taken from this reservoir for distribution.

Three Ingersoll-Rand motor-driven pumps are used at Cliff Lake, two 4,000 gpm. and one 1,680 gpm. One of the former operates 24 hours a day, the other being held as a standby. The smaller pump is used as needed to supplement the larger.

The wood-stave pipe is laid over very irregular ground, and there are seven high spots in the profile, at each of which an air inlet valve is placed to prevent collapse of the pipe should it be emptied quickly. There is a blow off at each of the eight low spots, permitting emptying of the line when necessary, which is done very slowly. Each spring, fire valves are placed at vulnerable spots along this pipe line to supply water to 1½" forestry hose. They are removed when cold weather arrives.

To prevent the freezing of this pipe line, two 60 hp. locomotive-type boilers were installed at the Cliff Lake pump house in 1930 to preheat the water entering the pipe line. They have been used only once—in November, 1946, when ice was found to be forming in the line.

The Distribution Systems

Water for plant use is pumped from the reservoir through a tunnel and a length of 24" wood-stave pipe to two wooden tanks on a tower, which are enclosed in a steam-heated building. The buildings of the plant are all steam heated, and are connected by boxes or tunnel-like houses in which are laid the steam lines and also the water and sewer pipes. The steam lines are insulated, but enough heat escapes from them to prevent the water pipes (which are of cast and wrought iron) from freezing. The pipe line boxes are above ground in some places, below in others, this being determined by the grade required for the sewers.

The town of Flin Flon has an independent and very interesting circulating system of water supply. High-pressure fire lines and low-pressure domestic lines are laid in circuits about 4,000 ft. long, through which the water is circulated continuously by pumping. Both main and return pipes for both systems, together with the sanitary sewer and storm sewer (all of these for any given circuit), are contained in one 4-ft. square wooden box. The sewers control the grade of this box, so that its position varies from 4 ft. above ground to 15 ft. below. For insulation, the boxes above ground are filled with sawdust or shavings; those below ground, because of wetness, are filled with cinders. Only about one degree of temperature is lost by the water while passing around a circuit. When the temperature of the circulating water at the pumping station drops below 38°, steam from a boiler is injected into the mains at a rate sufficient to keep the water temperature at 38°. This is necessary because freezing at any point in a circuit would result in the whole circuit freezing. No main has ever frozen, but house services occasionally freeze when the circulation is obstructed or the pipes are poorly insulated. I believe that the length of a circuit could be made greater than 4,000 ft. if the temperature of the water or the velocity of its circulation were increased.

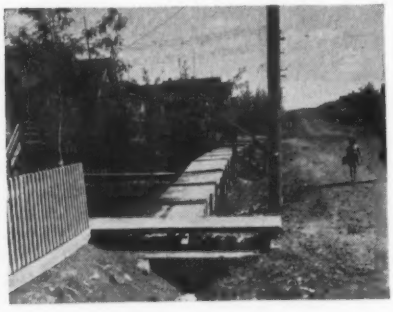
A portion of the town is not

reached by the distribution system but depends in a large measure upon delivery of water by truck.

The town avoids construction work in winter whenever possible because of the greater cost and of the possibility of the freezing of the water when turned into a cold, empty pipe. The company does construction work on its system whenever needed, regardless of temperature.

The water used by the town is chlorinated, as is that portion used at the plant for domestic or culinary purposes.

Sewage from the company's plant is treated in an activated sludge plant designed to serve 3,000 persons. The town treats its sewage by chlorination in a plant of its own.



Top: Sewer boxes at Flin Flon. Center: Type of box or tunnel used by company. Below: The Flin Flon wood stave supply line.

Water and Sewerage at Sherridon, Man.

M. R. C. MITCHELL

Chief Engineer, Sherritt Gordon Mines Limited

AT Sherritt Gordon Mines, Limited, both water mains and sewers are placed close together. In the town site they are laid in trenches about 8 ft. below the surface, which is supposed to be below the frost line. Around the mine areas they are carried in wooden boxes on the surface, together with steam pipes to provide heat, and sawdust is packed around them to protect them from freezing.

The Water System

Water for both the town and mine areas is taken from a lake near the center of the property, which is one of a series of lakes designated as being within a "sanitary area" and protected from pollution. Water is supplied through pipes to the town of Sherridon with approximately 200 dwellings, and to the areas around the mining camps; and also by means of water tanks to those not on the distribution mains. To supply the main shaft, the water is carried down a diamond drill hole to a pipe line along a drift in the mine workings and thence to the shaft.

The pumping station at the lake shore contains two pumps for the domestic supply, of 240 gpm. and 300 gpm., respectively, and a third for fire protection of 1,000 gpm. capacity. One domestic pump runs continuously, discharging through the several water mains into the dead ends of the sewers. There is little trouble in keeping the lake intake open, but it is necessary sometimes to blast holes in the ice over it to aerate the water. An average of about 150 pounds of chlorine per month is used, the rate varying with the amount of surface run-off, which is especially high in the spring and during any season of heavy rain.

The water mains are 2" to 10" cast iron with Victaulic joints. House connections are ¾" copper tubing. As most freeze-ups occur in these, their length are kept to a minimum, and it is a simple matter to thaw one, using a portable transformer.

Sewerage

The sewers that are laid in boxes are cast iron pipe; those that are buried are vitrified clay. Sizes vary

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Pictures of the Flin Flon system. Top, town ejector station; middle, plant sewage treatment; bottom, company plant water tower.

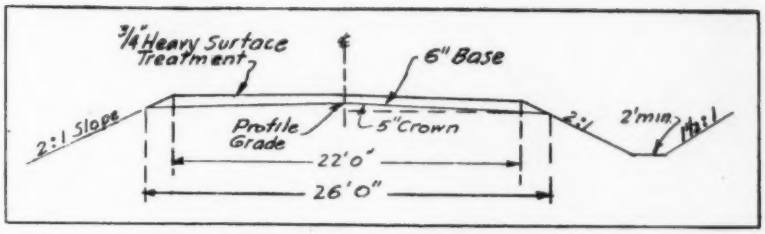
How We Built a Low Cost Stabilized Road

EDWARD WINKEL
County Engineer, Osceola Co., Iowa

AS TRAFFIC increases on secondary roads, engineers are faced with the problem of building better road surfaces, and usually this has to be accomplished with limited funds. The problems that confront highway engineers under such conditions are numerous, and there is plenty of room for all the ingenuity that the engineer possesses. This article is based on first-hand construction experience on a job of this nature, and is presented here with the hope that it may give other engineers information of value in solving similar problems. The history of this road goes back to 1941, when a farm-to-market road was constructed on our Trunk Road "A" out of Sibley. Our 1941 work consisted of grading, draining and gravel surfacing. The road was constructed 26 ft. wide and surfaced with 1,200 cu. yds. of gravel per mile.

Further Improvements

This road was maintained as a gravel road. Under heavy traffic it became very rough and "chucky." During 1943 we made an attempt to stabilize the gravel that was left on the road by pulling in the shoulders and using calcium chloride. This did alleviate the dust hazard but it was not successful as the black dirt from the shoulders did not make a suitable binder. All dirts are not suitable for this and the first prerequisite in building a base is to find a correct clay. The only way that this can be done is by taking field samples from suitable sources and then have the necessary laboratory tests made. Too much stress cannot be placed on this part of the work because it is the foundation of the construction work that follows.

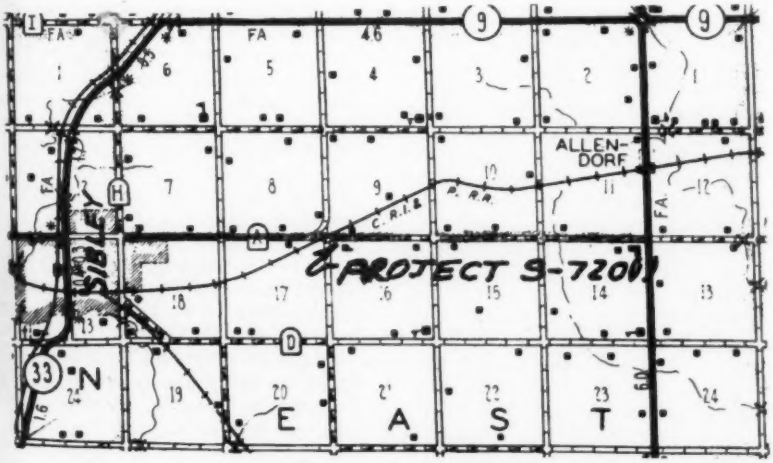


Section showing the finished road.

Since the work during 1943 did not give us much relief we decided that in 1944 we would start a stabilized base program that eventually would give us a base suitable for a blacktop surface. A suitable clay deposit was found near the road. A contract was let for placing 1000 cu. yds. of gravel per mile on the road in a windrow on one side of the roadbed. This gravel was equalized with a motor grader so as to give a uniform windrow throughout. After the gravel was on the road, clay was hauled and placed in a windrow on the opposite side of the road. This clay was worked with a motor grader to pulverize it and to put it in a uniform windrow. The clay volume was approximately 10% that of the gravel. After this procedure was completed, the clay and gravel were mixed thoroughly and placed in a windrow on one side of the road. Theoretically, this mixing should be done while the clay and gravel are dry. This we accomplished to a small degree but nature decreed that we should have rain and lots of it. Knowing that it was impossible to allow the unfinished job to go through the fall and winter, we gave up all hopes of mixing the materials dry and started to mix them wet. The mixing was accomplished by using two Austin "99" four-wheel-drive motor graders. This mixture in a wet or moist condition was laid on the road with a 6-inch crown for a 24-ft. roadway, and the material was rolled under traffic, though traffic was kept off the road while the material was being laid in order to save time in spreading.

Before the road became thoroughly packed, we had a rain and it became very slippery. At this point, criticism was offered very freely by the users. Finally we had some drying weather, and our blading and shaping was again resumed. The base packed down, dried and became very hard.

The results obtained from this



This shows the location of the project.

road were very satisfactory and our maintenance problems were improved. The road was maintained as a stabilized base during 1945 and calcium chloride was used to eliminate ravelling. We accomplished one thing in particular in that the gravel placed on the road was staying there in place of being kicked out into the ditch by traffic and blown away by the wind.

Placing a Black-Top Surface

In 1946 it was decided to black-top this road under a farm-to-market project. Our base thus far was only about three inches thick. This, we felt, was not ample to carry a black-top surface. Therefore, we decided to add a three-inch stabilized base to what we already had making a total thickness of approximately six inches. Contracts were let for this work but the bids were so high that it was decided to reject all bids and again construct the base under maintenance forces. Similar procedures were followed as for the first three-inch base except this time, the work had to be completed within a certain time limit. The mixing was carried on with a Seaman Pulvi-Mixer; when the rainfall was too light, water was hauled in order to obtain the optimum moisture content of 8%. Sheepsfoot and pneumatic rollers were used to obtain the density required. Blading and shaping was carried on by motor graders. A very satisfactory result was obtained and the base was ready for a black-top surface.

The black-top surface was constructed by contract. Cost data on this road are shown below.

Since the road was five miles long, the average cost of the completed job was $5,105 per mile.

In my opinion, counties with limited funds can carry on an improved surface type program by doing the stabilized base work under maintenance and the bituminous surface work under contract. To construct a stabilized base within a certain contract, time involves so many hazards, such as weather, that a contractor is at a loss just what to bid and necessarily he has to bid high enough to protect himself and even then he may be on the losing end. A stabilized base can be constructed within a certain time limit but the obstacles are many and the cost high.

Clay, in a windrow on the road, 1,489 tons		$ 1,022.59
Gravel, also placed in a windrow, 8,977 tons		4,978.99
Construction of base by force account		2,522.07
Previous investment in base		5,327.12
Total cost of 6-inch base		$13,850.77
Bituminous Surface:		
Cover aggregate, 1,895 tons at $3.45	$6,537.75	
SC-5 binder, 28,813 gals. at 11.6¢	3,342.30	
Mc-1 primer, 16,004 gals. at 11.2¢	1,792.45	
Total cost of surface		$11,672.50
Total cost of base and surface		$25,523.32

Winnipeg Incinerator Tests

(Continued from page 20)

2.05 kwh. The test of all three furnaces was made on Feb. 13, and during a 6-hour period 68.6 tons of refuse were actually incinerated, equal on an adjusted basis to 81 tons, or at an average rate of 324 tons per 24 hours. The average combustion chamber temperature on No. 1 furnace was 1651°; on No. 2, 1551°; and on No. 3, 1428°. Power use during this test averaged 1.84 kwh per ton of refuse burned. The ash removed amounted to 16.9 tons, or 18.7% of the refuse burned, and contained 2.6% of moisture. The refuse, as burned, contained 48.7% of moisture and 6,101 btu. per lb. of dry solids.

In the individual tests, No. 1 furnace burned at the adjusted rate of 127 tons per 24 hours; No. 2 furnace at the rate of 114 tons; and No. 3 furnace at the rate of 103 tons. The moisture content and btu values for the refuse used in the three furnaces was: No. 1, 56.4% and 5,940 btu; No. 2, 53.3% and 4,892 btu; No. 3, 46.9% and 4,835 btu.

The above figures include cans and bottles. If these are excluded, the moisture content is much higher—64.07% for No. 1, 67.45% for No. 2, 55.8% for No. 3, and 56.31% for the combined test. On all samples, the amount of moisture averaged 94% of that taken as standard in the specifications, while the heat content averaged 82% of that specified. No adjustment was made for the latter deficiency as it was possible to maintain the guaranteed temperatures without the use of auxiliary fuel.

Before starting the tests, it was agreed that an adjustment should be made in the quantities actually incinerated to allow for the fact that the refuse was frozen. Thus, in all cases, 18% was added to the amount actually incinerated to determine compliance with the guarantee. This factor was computed from the heat required to raise the ice temperature from 0° to 32°, to melt the ice, and to raise the water to 212°. Btu required for operation with garbage at 70° amount to 1,112 per pound but when garbage is at 0° 1,312 btu are required. This fixes the adjustment factor at 1312/1112 or 1.18. This adjustment did not take into account the heat necessary to raise the steam to the temperature of combustion, but neither did it allow for the time required for heat to penetrate to the interior of the frozen masses of garbage.

The tests showed that the furnaces and appurtenances met the guarantee as to capacity, chimney discharge, men required on the stoking room floor, power consumption, and auxiliary fuel.

Far North Water and Sewerage

(Continued from page 22)

from 6" to 18". Grades are made as flat as possible to keep excavation to a minimum, as much of it is in rock. Soil pipe inside the buildings is 4" cast iron. Manholes are located at short intervals to permit cleaning with short lengths of sewer rods.

The townsite has a large septic tank, and each of the shaft areas has from one to four smaller ones.

General

Considering the temperatures of the district, both water and sewerage systems work very satisfactorily. The initial cost of laying pipes underground was considerable, as a great deal of rock had to be excavated to secure a grade below the frost line; and the cost of repairing breaks is greater than for the more easily accessible pipes in boxes. On the other hand, the upkeep cost of heating the pipes in the boxes by steam is quite high. The system of records does not furnish data which permit an exact comparison of the costs.

In the areas around the mines, the boxes enclosing the pipes are kept as large as possible, so that work can be done inside the box itself, without the necessity of opening the box from the outside.

Diesel Engine Standby for Water Works Pumping

THOUGH located on one of New England's major rivers, Manchester, N. H., gets its water from Lake Massabesic, some 4½ miles away, which has an area of 4 and a watershed of 40 sq. mi. Because there is a considerable difference in elevation between the lower and the higher portions of the city, there are two distribution systems and two pumping stations. The high-pressure pumping station on the lake shore delivers to a 21-million gallon reservoir on Tower Hill, three miles away and 398 ft. above the city base.

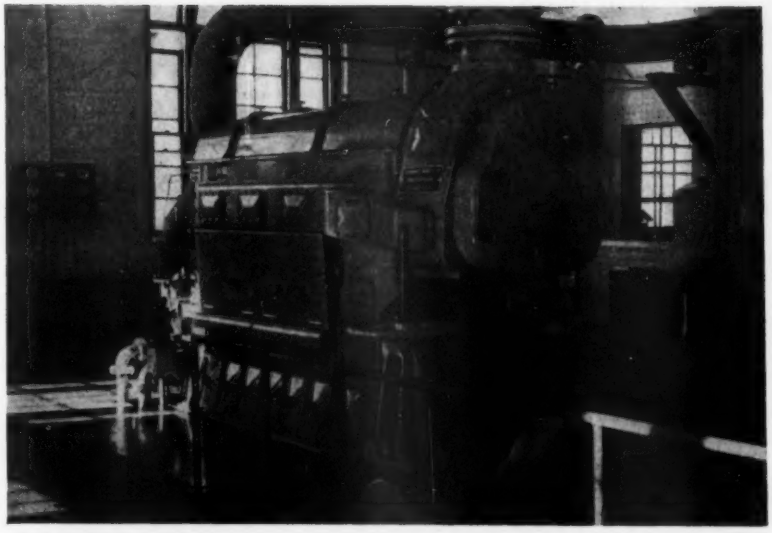
Pumping Equipment

Originally, two Worthington steam pumps, with a total capacity of 6 mgd, were installed. A Snow steam pump, added in 1902, increased daily capacity to 9 mgd. The Worthingtons were removed in 1914, and a year later a 3 mgd DeLaval centrifugal was installed. In 1917, a 6 mgd DeLaval was added and in 1940 the older DeLaval was replaced by a 7 mgd Ingersoll-Rand. The Snow steam pump was dismantled in 1946, after serving as a stand-by unit for six years.

A Fairbanks-Morse diesel unit has now taken the place of the Snow as a stand-by. The prime mover is a six-cylinder, 960-horsepower, Fairbanks-Morse opposed-piston diesel. It operates at 720 revolutions a minute, and drives two 16" Fairbanks-Morse centrifugal pumps direct-connected in series. The capacity of the unit is 12 mgd at a total dynamic head of 305 feet. The jacket water circulating pump and the lube oil filter are Fairbanks-Morse, and there is an American air filter, an Alnor pyrometer, a Curtiss compressor, a Ross lube oil cooler and heat exchanger, a Marshalltown gauge board, a Maxim silencer, Diesel Specialties tanks and Cutler-Hammer starters.

In the adjoining room at the high-pressure station are the 6 mgd DeLaval, new in 1917 and rebuilt in 1940, and the 7 mgd Ingersoll-Rand (1940). Each is powered by a 400-hp General Electric motor. These motor driven units are intended for regular service while the diesel unit is held available as a stand-by.

During normal periods, electric energy to drive the pumping motors is furnished in part and without cost from a 375-kilowatt water-driven generator connected to twin turbines at the low-pressure station. Deficiencies in this supply are made up by power bought from the Public Service Company of New Hampshire, and the presence and occasional use of the diesel unit enable the Water Works to avoid high demand charges.



This Fairbanks-Morse diesel engine is used as standby and for pumping.

Interconnections

Manchester's two complete and independent water systems permit a high flexibility of operation. There are two pumping stations, two reservoirs and two distribution networks —but each can aid the other in case of emergency. Should pressure fall too low in the low-pressure system, the high-pressure lines can be cut in. If the high-pressure system proves inadequate at any time, a booster station will cut in the low-pressure supply and raise pressure to a normal level. At the booster station there are two pumps, each a 6" Fairbanks-Morse centrifugal. Each pump is driven by a 95-hp Lincoln Zephyr gasoline engine, and the capacity of the booster plant is about 3 mgd.

Percy A. Shaw has been Superintendent and Engineer of the Manchester Water Board since 1933. Under his direction, the city's supply and distribution systems have operated with an unique flexibility and reliability. Mr. Shaw credits Manchester's low water rates to the adaptability of the system and to the fact that he has always insisted that the department operate on a "pay as you go" basis. The Water Department is permitted to set up its own surplus fund, completely independent of the city treasury, and because of this autonomy, its indebtedness can be kept at a low level, and its rates on an equally low basis. Recently there has been a slight increase in rates, but Manchester still compares most favorably with any of New England's cities of comparable size which must pump their water.

Manchester's water use averaged 5 mgd in 1938, but by 1947 this had increased to 8 mgd. The greatest proportionate increase came in 1939, at which time the City Water Department took over the job of supplying the Amoskeag area.

At present, the demand is about 9 mgd, and the Fairbanks-Morse unit has been carrying most of this load since the first of the year. Though installed as a stand-by, the diesel operated for almost the entire month of January and will continue to run several days a week.

Sewage Treatment by CONTACT AERATION

G. R. HERZIK, JR.
Engineer, Texas State Department of Health

There has been much discussion of the method of sewage treatment by contact aeration. Here are data based on results in the files of the Texas State Health Department as interpreted by Mr. Herzik. Table I herewith is somewhat condensed from the data furnished us.

FOR a period of almost two decades, there has been in Texas an interest in the principle of sewage treatment known as contact aeration, frequently referred to as the Hays Process. In the late twenties, Clyde H. Hays, then City Chemist of Waco, Texas, initiated studies, including a small pilot plant, of this principle of treatment on municipal sewage reaching the disposal plant in Waco. For about ten years these studies were conducted in a very localized manner, with no special attempt being made to promote the use of contact aeration as a general method of sewage treatment, though several plants were installed prior to World War II.

Fig. 2. A contact aeration plant at a Texas air field.

With the advent of the war and the need for sewage treatment facilities at many military installations, interest developed in contact aeration for military treatment of sewage. Although Mr. Hays had accumulated considerable operational and design data, it was felt that he could hardly be considered as an impartial observer. Therefore, it was natural that the Texas State Department of Health would be asked for data on the plants in that state.

Unfortunately, at the time, the State Department of Health had done very little independent detailed study of the work being done by Mr. Hays, although he had kept the Department fully informed and was most generous in making his own records available to them. Normally, upon the receipt of so many inquiries, the Health Department would have initiated comprehensive studies; however, this was prevented by the combination of increased public health activity due to the war, and the severe loss of personnel to the Armed Forces. Sufficient investigation by the State Department of Health had been made, however, to be assured that the more recent developments of the principle of contact aeration had promise of merit. Consequently, contact aeration was given equal consideration with other types of sewage treatment processes when presented for approval to the Health Department by consulting engineers.

The most comprehensive compilation of data covering contact aeration plants at Army installations is contained in the report of the Subcommittee on Sewage Treatment of the Committee on Sanitary Engineering of the National Research Council entitled "Sewage Treatment at Military Installations." Chapter VI of this report deals specifically with this type of plant, and since the report has been published by the *Sewage Works Journal*, no attempt will be made to review it here. It is well to point out, however, that the report contains data which, it is believed, could be useful in further evaluating design criteria.

The following quotation probably will summarize the reaction of the Committee regarding the use of these plants for military installations: "Under favorable conditions of loading and sewage concentration, good effluents were obtained, with over-all removals of BOD averaging 80 per cent to 95 per cent in the plants selected for study. When strong stale sewage had to be treated, however, or when difficulties developed in the aeration system originally installed, effluents were unsatisfactory, odors became intense, and first aid measures had to be applied in order to keep the plants in service." It seems that this type of comment need not be limited to the process under discussion but could be generally applic-

Fig. 3. The original experimental plant at Waco.

TABLE I - DESIGN DATA

City or Camp	Garland	Sheppard Field	Perrin Field	McGregor	Palacios	Elgin	Camp Hood	Big Spring
Date Sampled	1942	1943	1942	1943	1943	1945	1943	1946
Population	500	34,400	2,710	1,000	3,000	2,000	44,300	15,000
Flow, Av., Mgd.	0.052	1.34	0.145	0.0625	0.202	0.059	3.37	0.95
BOD, raw, ppm.	193	476	234	237	390	248	391	315
BOD, Pri. Eff., ppm.	106	326	188	119	250	162	198	173
BOD, 1st Stage, ppm.	52	147	94	70	192	55	161	96
BOD, 2nd Stage, ppm.	15	90	66	14	85	44	93	24
BOD Reduction, aver.	92.3%	81.3%	71.8%	94.3%	78.3%	82.3%	76.2%	92.5%
Sq. Ft. Plates/#BOD	655	117	126.5	182	188	244	145	160
Air, cu. ft./gal.	4.6	2.91	2.25	3.30	1.0	...	1.21	2.61
Aeration, total, hrs.	3.20	4.28	2.40	4.80	5.2	1.48	4.73	3.0
Primary Detention, hrs.	4.17	2.69	3.37	1.86	2.41	1.99	1.51	2.99

able to other types of sewage treatment processes as well.

A survey indicates that abundant data still are not generally available. Especially is this true with regard to published material, and it was therefore felt that if this article were devoted to a resume of information contained in reports prepared by the State Department of Health, it might be a helpful contribution to the designers of sewage treatment facilities.

Design and Operation

For the convenience of the reader a brief description of the units comprising a Hays Process plant is included. A typical plant might include screening, grit removal, primary sedimentation, first stage aeration, intermediate sedimentation, second stage aeration, final sedimentation, and chlorination with sludge digesting and drying facilities.

Essentially, no difference exists between the primary treatment units of this type of plant and the other types utilizing biological secondary treating methods. Conventional screens, comminutors, grit chambers, grease removing units, and primary settling units are generally adaptable to this process. Sedimentation for two hours on the basis of average hourly flow is considered suitable for effective conditioning of the sewage prior to its introduction into a first-stage aerating unit. The first-stage aerating unit is followed by an intermediate settling tank generally designed to retain the sewage for one hour.

The secondary aeration unit and final settling tank are usually identical with the first-stage aerating unit and intermediate tank. In the aerating compartments are asbestos plates with horizontal intervals between the plates varying from 1.25 inches to 2.5 inches. Some of the earlier aerating units were filled with rock instead of the asbestos plates now used. In each aerating unit the sewage enters at the bottom where it is mixed with air, flows upward between plates covered with zoogleal growth and is drawn off at the top above the submerged plates over an effluent weir at the end of the tank. The two aeration compartments are designed theoretically on the basis of a total of 82 square feet of asbestos plate surface per pound of settled BOD loading per day. One-half of the plate area is placed in the first-stage aerating unit, with the other one-half in the second-stage compartment. It has been found desirable, however, to increase the plate surface area by 50 per cent for satisfactory operation during peak loadings, thus providing 123 sq. ft. of plate surface per pound of BOD.

TABLE II - BOD REMOVALS

City or Camp	Raw	Primary	Inter-mediate	Final	% Rem.	Year
Brooks Field	210	330	45	38	82.8	1942
"	100	65	60	45	55.0	"
"	350	68	45	15	95.8	"
Elgin	180	0	0	0	100.0	"
"	600	190	...	20	96.7	"
"	210	60	14	10	93.5	1940
"	200	95	11	9	94.5	"
Foster Field	200	130	40	35	81.1	1942
"	125	50	33	12	90.4	"
Garland	200	118	26	11	95.2	1940
"	185	110	13	8	95.9	"
"	208	100	24	10	95.3	"
Harlingen	335	40	32	10	97.0	1942
Lubbock	260	70	...	10	96.3	1943
"	100	55	52	22	78.0	1942
Luling	250	110	47	25	90.0	1943
McGregor	120	25	8	5	96.0	1942
Midland	60	52	13	4	90.3	"
Moore Field	160	145	88	49	69.3	"
Palacios	260	170	36	37	85.0	1943
Perrin Field	95	86	75	4	95.3	1942
Sheppard Field	214	80	150	70	67.2	1942
"	230	130	83	13	94.5	"
Waco	352	140	27	10	97.5	1939
"	230	115	27	9	96.0	1940
"	245	150	23	8	96.8	"

Sludge from the aerating and clarifying units, as well as from the primary settling unit, is taken to a separate sludge digester designed on the basis of about three cubic feet per capita. Sludge drying beds are usually designed on the basis of about one-half square foot per capita. From one to two cubic feet of air at a pressure of four pounds per square inch is recommended for each gallon of sewage treated.

In plant operation, the pH concentration is one of the most important factors affecting the development of the organisms in the aerators. It appears that the optimum pH range for this type of biological treatment is from 6.8 to 8.8. In theory, the organisms differ in the two contact aerators. In practice, it is important that the environment of the two groups of organisms is not changed throughout the course of their life cycle, as by marked changes in loading.

Sludge is usually removed from the units at about 4-hour intervals, with intervals being somewhat shorter during the day and longer during the night. Extreme care must be taken in handling the supernatant liquor from the digester, especially if it is in an acid condition. When this condition exists, sufficient lime should be

added prior to introduction into the primary settling unit to bring the pH up to 9.0 or 9.5. It may be desirable to construct a small tank between the digester and primary settling tank, large enough to hold one-fourth of the daily supernatant flow, with equipment for aerating for at least one hour, in addition to the use of lime for increasing the pH. After this material is settled, the clear liquid is passed on to the primary settling tank, while the sludge is returned to the digester.

Biology of Contact Aeration

In June, 1943, Senior Biologist James B. Lackey, of the Cincinnati Station of the Stream Pollution Division of the U. S. Public Health Service, made some observations regarding the biology of contact aeration plants in Texas. Eleven plants were examined, located as far north as Sherman and as far south as Eagle Pass on the Rio Grande. Mr. Lackey found that in the aerators distinct zonation of growths were visible in most of the plants. Usually there was a small amount of green or blue-green growth on the very top of plates, spacers, walls, and other structures close to the upper water surface. Below this was a zone about six inches deep, pink or dark red in color, changing at its lower end into a narrow green zone, or sometimes a brown zone. The remaining depth of the plates and walls contained a dark brown or grey film with occasional white patches.

In no plant were streamers found extending from one plate to an adjacent one; they were always freely waving and loose at one end. Thick masses of film were found in some of the plants. With reference to filamentous organisms, only three species were normally found within the aerators, though in a few instances others were found at the very top. It was found that only *Beggiatoa alba, Sphaerotilus natans*, and an unbranched tenuous fungus occurred below the top six or eight inches. Stalked ciliates were present in only a few of the plants.

With reference to all types of organisms observed, it was noted that 71 distinct groups were found. It was believed that 39 of these could be regarded as more or less common inhabitants occurring in three or more plants. *Beggiatoa alba* and *Zooglea ramigera* were abundant at times and occurred in all 11 plants, while the red sulphur bacteria and the green bacteria occurred in 10 plants. *Chromatium sp.* occurred in six plants, *Sphaerotilus natans* in nine. *Chlorella vulgaris* and *Chlamydomonas sp.* in eight and seven, respectively. In the plants examined, heavy emphasis seemed to be placed on sulphur metabolism as there was a widespread and abundant flora of sulphur utilizing organisms. Most of these organisms seemed closely related to Thiocystis. The sulphur bacteria seemed to be present regardless of whether the water supply was high or low in sulphates. In most cases the total number of Protozoa was very small.

Summary of State Health Department Reports

Complete reports have not been made for all of the 50 or more plants of this type operating in Texas. Table I included herein, summarizes results secured from studies covering eight plants for which complete reports are available in the files of the Bureau of Sanitary Engineering of the Texas State Department of Health. The analyses given are based on composite samples, and the following abbreviated narrative summaries of the various plant reports point out the condition of loading as well as other features that might be helpful in evaluating Table I. It should also be kept in mind that the results described herein represent conditions existing at the time of a specific study, as some of the plants are now grossly overloaded, while others, especially in the case of Army installations, have had their load reduced considerably below the figure for which the plant was designed. Representatives of the Hays Process Company claim that the exclusive use of porous diffuser tubes for air distribution in plants now being built, in lieu of perforated pipe used in earlier plants, will improve operating results.

There is also included herein Table

(Continued on page 40)

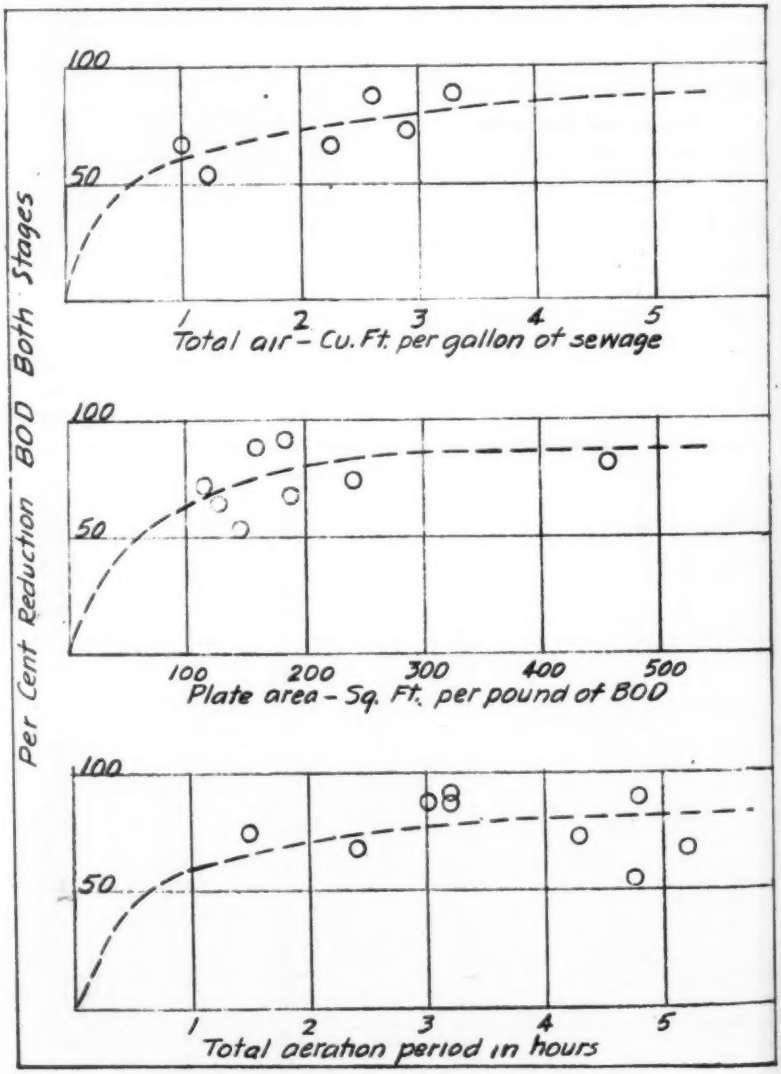


Fig. 1. BOD reduction as affected by various factors.

Tacoma Lays

FOUR MILES OF 58-INCH PIPE

A. R. McPHERSON

IT IS expected that the year 1948 will see the completion of Tacoma's program, begun two years ago, of rebuilding its water supply system at an estimated cost of nearly $3,000,000. This reconstruction was necessitated by increasing consumption and also by the deterioration of the 23,000 ft. of wood-stave pipe line, laid in 1913, which brought the supply from the headwaters of the Green river to the city's reservoirs.

The average daily consumption of the city is 55,000,000 gallons, rising to a peak of 100,000,000 in summer. Over two-thirds of this is used by industries, of which there are some 260 in the city. One large pulp and paper-mill alone requires 17 mgd. The capacity of the wood-stave line was 42 mgd, which was supplemented with a deep well system located in South Tacoma. The new pipe line will have an estimated capacity of 67 mgd, which, with the well supply, will give a total of 100 mgd.

The substitution of the new line for the old line will also prevent serious losses of water by leakage from the old line and result in improved pressure in the city's distribution system.

The New Pipe Line

The new pipe line is laid with 58-in. steel pipe, in 36-ft. lengths, with joints welded in the trench. The pipes are coated with 1/16-in. of coal tar enamel, spark-gap tested with 15,000 volts to insure absence of defects in the coating. The pipes were furnished by the American Pipe and Construction Co. of Portland. The work of laying has been done entirely by the city itself, using its own engineers and its own equipment and a crew of 75 men.

The trench for the pipe line was dug 12 ft. deep. Difficulty was caused by the existence of a treacherous peat bog which extended over 8,000 ft. of the pipe location; through which a small creek wandered crossing the pipe line several times; and in which were buried numerous sound logs, possibly centuries old. The clamshell buckets used for excavating the trench were unable to handle these logs, being damaged in the effort, and hand methods had to be used for removing them.

This peat bog section is normally

(Continued on page 50)

Construction views on Tacoma's pipe line job. Above, one of the Northwest cranes; middle, grading trench ahead of pipe-laying; bottom, Jaeger compressor supplying air to welders working inside the pipe.

How Glendale, Arizona, Settled the Dust

The story of a paving program which is giving this city of 10,000 population a mark of distinction—100% paved streets!

As told to DEAN E. SMITH

By J. D. "Bud" Baughman, Glendale City Manager, and Hugh Pelphrey, City Resident Engineer

LESS than a year ago the city of Glendale, Arizona, had only 47,392 square yards of paving, and that was to be found only on half a dozen of its streets. By late summer of 1948 that same city will be one of the few in the United States which has every one of its streets paved, and will have a total of 327,192 square yards of paving, as well as 92,631 lineal feet of curbing. Such an achievement is almost unparalleled in the annals of municipal paving history.

To add to this record, Glendale can boast that this rather amazing yardage has been added at a total cost of only $638,572, an average of $1.37 per square yard for paving and $1.60 per lineal feet for curbing. The latter feat was possible because paving in Central Arizona's mild climate may be laid with a thickness of as little as two inches. This condition allows for a much smaller cash outlay than would be the case in a climate of freezes and thaws, where paving must be laid five or six inches thick.

Making a Start

Several factors were responsible for this city-wide paving project. Most important of these was the rapid growth of the city—a growth which brought Glendale from a population of 4,865 in 1940 to an estimated 10,000 today. The dust and mud were bad enough in 1940 but, with a doubled traffic problem, the inconveniences of gravelled streets became almost unbearable. Then too, Glendale's citizens became more civic minded as their city grew and they began talking seriously about paving.

Before 1946, only the two main streets, the area around the city square and two short residential streets had been paved. Moreover, much of this paving had been put in without curbing. In 1936 a group of citizens had tried to get a paving program started but had discontinued their efforts when they discovered that most people felt it would be too expensive.

In the summer of 1946, however, a group led by Vance Harer, Glendale insurance man, proposed to the local chamber of commerce that petitions be circulated in the northeast quarter of the city as the first step toward paving at least a portion of Glendale. The petitions were circulated and when 65% of the property owners had signed them, they were presented to the city council. Little opposition to the paving plans was encountered. On May 20, 1947, the council passed a resolution of intent to pave the 49 blocks in the northeast quarter. On June 3, bids on the paving of the district were opened by the council. On July 7, the Fisher Contracting Co. of Phoenix, nine miles away, started the job. Although delayed for two weeks by labor trouble, the paving of the district was completed on December 10, 1947.

J. D. Baughman, city manager, discussing details of laying the seal coat with Hugh Pelphrey, right.

Meanwhile, in May, 1947, J. D. "Bud" Baughman was appointed city manager of Glendale and Hugh Pelphrey took over the job of resident engineer for Headman, Ferguson and Carollo, Glendale city engineers. Shortly after the paving of the first district got under way, Baughman and Pelphrey mapped out three other improvement districts, comprising the southeast, southwest and northwest quarters of the city. Petitions were circulated and for several months thereafter the Glendale city council was kept busy passing resolutions of intent to pave, advertising for bids, awarding contracts and transacting the numerous other items of business incident to the supervising of a paving program which by that time had become city-wide.

Equipment and Methods

The Fisher Contracting Co. used a 15 cu. yd. capacity Le Tourneau carry-all for sub-grading the northeast district, but the Tanner Construction Co. of Phoenix, which bid low in the other three districts, used an Athey loader with dump trucks for the sub-grade in those districts. A 6-inch aggregate base course was used throughout the project.

In the residential districts, 2-inch asphaltic surfacing was laid, while on business section streets an asphaltic concrete surface 2½ inches thick was laid. A part of the asphaltic surfacing used contained 5% of SC-6 but an 85-100 penetration asphaltic concrete was also used. The Barber-

Greene tamping-leveling finisher was used by both the Fisher and Tanner companies and proved most satisfactory.

Many business firms and a few residential property owners contracted separately for valley gutter in front of their property. Lineal feet of this gutter in the northeast district totaled 4,000; in the southeast, 2,940; in the northwest, 1,900; and in the southwest, 885. A total of 9,725 lineal feet of this gutter, which provides a smooth parking area off the travelled street, was laid.

Two types of curb and gutter were put in. A total of 44,527 lineal feet of 4-inch integral curb and gutter was laid and 39,270 lineal feet of 6-inch combined curb and gutter will have been laid by the time the job is completed.

The contract price for paving and curbing in the northeast district was $224,716. The job called for 91,300 square yards of paving and 40,000 lineal feet of curb and gutter. Engineering and legal advertising costs for this district ran an additional 8% of this figure, thus bringing the total cost to $242,493. Exact figures on engineering and legal advertising costs in the other three districts are not yet available but they are expected to run about 8% over the contract price also.

It is interesting to note the comparatively low cost of engineering and legal advertising for the Glendale paving project. The 8% figure for these services compares with 12% in the neighboring city of Phoenix and a national average of about 15%.

Contract prices in the other three districts were as follows:

District	*Yards Paving*	*Feet Curbing*	*Contract Price*
Southeast	94,000	9,687	$175,479
Northwest	65,100	21,600	126,979
Southwest	29,400	12,510	64,278

Average unit costs in all four districts for grading, aggregate base course, asphaltic concrete, asphaltic pavement, curb and gutter were as follows:

Grading	$0.335	per sq. yd.
2½-inch asphaltic concrete (85-100 pen.)..	.75	per sq. yd.
2-inch asphaltic pavement (5% SC6)....	.57	per sq. yd.
Aggregate base course..	.43	per sq. yd.
6-inch combined curb and gutter	1.65	per lineal ft.
4-inch integral curb and gutter	1.58	per lineal ft.

Financing the Projects

For the most part, Glendale's residents have only average incomes. Thus the problem of financing the paving project is about the same as that which would be encountered by any small city. Residents of the southeast quarter of the city voted to pave their streets despite the fact that the district is composed almost entirely of Spanish-American residents, whose incomes are considerably below average in a majority of cases.

Since direct assessment was used in financing the project, Glendale's paving will not affect the tax rate at all. Property owners were assessed according to their benefit from paving and were given an opportunity to pay cash within 30 days. At this writing, assessments have been made only in the northeast district, where 40% of the project cost was paid in cash before the deadline. According to Arizona law the remainder of the cost then went to bond and 5% interest for ten years was added to each unpaid assessment. Property owners now have ten years in which to pay up their assessments, but a payment must be made each year. Financing of paving in the remaining three districts will be handled in the same manner.

Barber-Greene tamping-leveling finisher in action on Glendale streets.

Other Considerations

In order to avoid tearing up sections of the new paving within the next few years, the sewer and water departments of the City of Glendale replaced more than 15,000 feet of seven to twenty-year-old galvanized water pipe and installed eight-inch vitrified sewer mains on streets which were about to be paved. Copper tubing, which will far outlast the life of the new paving, was laid in place of the galvanized pipe. Worn galvanized water mains were replaced by cast iron and Transite mains and in many cases the mains were enlarged to accommodate the city's rapidly growing population.

Glendale city officials and a majority of the city's property owners firmly believe that the paving project will pay for itself almost immediately in terms of increased property values alone. But this is only one of many benefits which the paving will bring within the next five years. Smooth, dust-free streets have already attracted hundreds of prospective home owners who once would have searched elsewhere after one look at the clouds of dust which arose in the wake of every passing vehicle.

Housewives already can see a marked difference in the amount of dust which blows into their homes. Residents who once gave up any attempt to beautify their yards and parkways now have a new incentive to plant grass and flowers to meet the smooth white curbings in front of their homes. Glendale is already becoming a healthier, more beautiful place in which to live.

Between December 10, 1947, the completion date of paving in the northeast district, and April 1, 1948, the city issued building permits totalling $353,187 in new construction. More than $250,000 of this figure was residential building and about three-fourths of the new construction was in the northeast district.

One other major benefit, best appreciated by residents of Arizona where the annual rainfall is about eight inches, is the fact that with all of Glendale's streets paved it will no longer be necessary to give streets the sprinkling which used to be an almost daily necessity. Before the paving was put in, the City of Glendale used more than 60,000 gallons of water per day for this purpose. An old saying in this state is that "it's a sin to waste water in Arizona." No longer may the residents of Glendale be listed among the sinners.

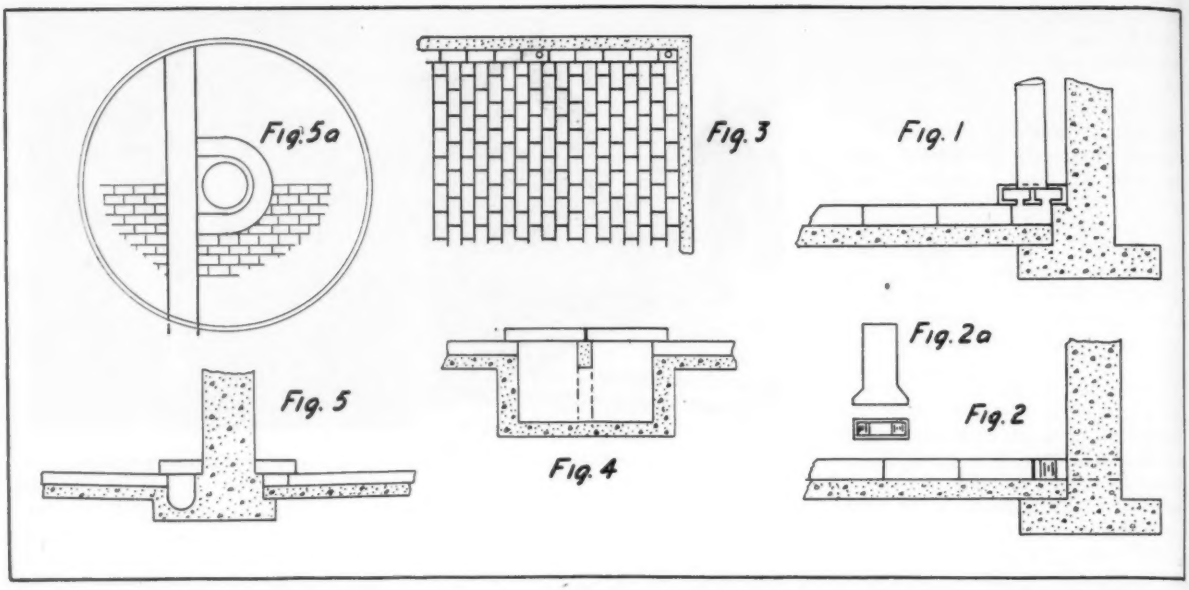


Fig. 1. Underdrains, not mitered, are extended to or near wall and cover block is placed over ends, with tile riser where desired. Fig. 2, ventilator or wall reducers, shown in 2a, are extended through wall for ventilation. Fig. 3, layout for a square filter. Fig 4, recommended treatment for channel more than 24" wide, using 6" partition wall. Fig. 5 and 5a, layout and detail for an offset channel.

Small Sewage Treatment Plants

VII—Detailing and Designing Small Trickling Filters

MINOR items of design in a small trickling filter include walls and floors, methods of placing the underdrain block, provision for ventilation, location and construction of effluent channels, the dimensions of the distributor support, the spacing of fixed nozzles, and the design of the dosing tank or siphon.

Walls may be of concrete, tile blocks, or stone. They need not be tight unless it is desired to flood the filter for fly control—not necessary in most cases now that means of filter fly control are available through the use of DDT. If the walls are of concrete or tile, they should be reinforced. With any filter, the walls should be designed for stability with full earth pressure and no stone in the filter; and with stone in the filter and no outside earth support. A thickness of 6" to 8" is sufficient. Adequate footings should be provided. When a stone wall is used, a gravity section is preferable or necessary. A freeboard above the stone of about 6" is desirable, except with the aerofilter where higher walls are usually provided to prevent wind interference with the spray from the distributor arms.

Floors and Underdrains

The floors should be of concrete, placed on a uniformly well-compacted earth base, though the loading on the floor is not great, even with deep filters. A floor thickness of 6" is desirable for larger filters or where the earth support is not of first quality. On smaller filters and with a good earth subbase, 4" floors may be sufficient. Light reinforcing is almost always used. The principal objective is to provide a floor that will retain its uniformity, insuring good drainage. Since the floor is intended primarily to support the underdrains, it need not be finished to excessive smoothness. The floor should be sloped to the drainage channel at the rate of 1% on large filters, with a minimum slope of 3" in all cases.

Block underdrains (see Trickling Filter Handbook) are desirable to insure good drainage and ventilation. These are so placed on the floor, on wet or dry grout, as to provide uniform continuous flow channels to the center drain from all parts of the filter. With a circular filter, the rectangular blocks do not fit closely to the curve of the enclosing wall. In many cases, blocks have been mitered or cut so as to provide an approximate fit. This is not necessary, adds to the cost and may delay the work. The square end blocks may be laid just as though mitered; this will leave triangular spaces at the end of each line of blocks. These spaces may be filled with lean grout, finished so as to slope slightly away from the wall, thus providing good drainage, with no dead spaces for the collection of organic matter. If additional ventilation is desired, ducts can be inserted through the wall: or inverted or cover blocks placed over the drains at the periphery of the wall, and blocks with vent pipe openings inserted in these wherever it is desired to place risers.

The necessity for providing ventilation in excess of that obtainable with the open type of floor construction, such as is provided by filter underdrain blocks, is a matter of some difference of opinion. Of much

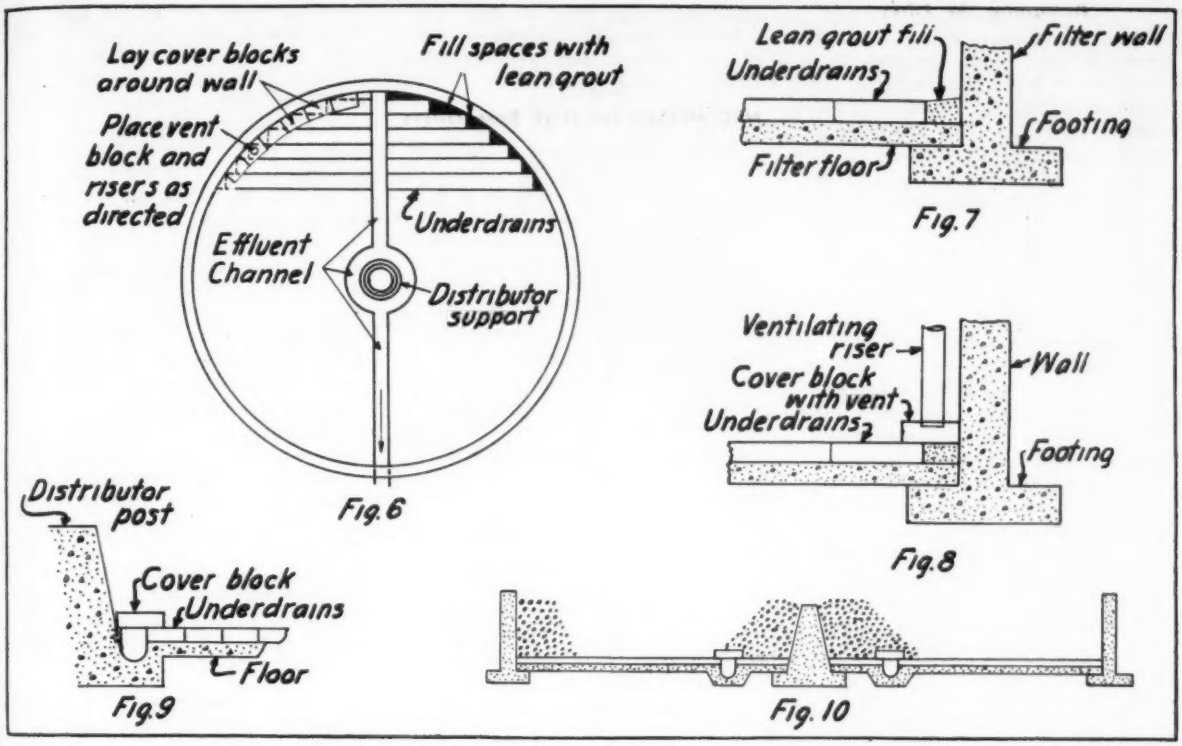


Fig. 6, layout of filter, showing blocks not mitered, and cover blocks. Fig 7 shows detail without cover or vent blocks, Fig. 8, with cover blocks and vent. Fig. 9, detail of construction around distributor support. Fig. 10, use of two channels for larger filters to avoid channel around distributor support.

greater importance is the careful selection and placing of dust-free, clean and properly graded filter media. If dirty stone, with fine material in it, is used, the most carefully designed filter will be inefficient, and added ventilation will be of no benefit.

Effluent Channels

To remove the filtered sewage, a covered channel must be provided through the filter. In most cases, this is at the approximate center line. The channel should be large enough and have enough slope to carry off the sewage at times of maximum flow without flooding the underdrains. On low rate filters with a tight sewer system, maximum flows may be two or three times the average. With high rate filters employing recirculation, the rate of application will be very much higher, but it will be more uniform.

When carrying the maximum flow of sewage, the surface of the sewage in the effluent channel should be slightly below the bottom of the underdrain channels in the filter. In designing effluent channels, usual flow formulas (or tables) for channels or pipes may be used.

The design of channels differs somewhat for shallow high rate filters and for deep filters. In the shallow filter, the feed pipe for the distributor must generally pass under the filter and up through the distributor support, while in the deep filter the feed pipe is usually passed through the body of the filter media. With the shallow filter, the channel may be offset from the center, a central well used, the channel carried around the distributor support, or two channels may be used. With the deep filter, a split channel or a central well may be employed, or the channel may be passed through the distributor support. Various designs are shown herewith.

The effluent channels must be covered to support the filter media above them. The perforated vitrified clay channel covers frequently used are difficult to obtain in lengths greater than 30". With 3" of support at either end, the channel width is limited to 24". On large filters, where a wider channel is required, a central support may be provided; or two channels used, one on either side of the distributor post.

The height and dimensions of the distributor post will depend on the make of distributor used. Information on this must be obtained from the manufacturer. Anchor bolts will have to be set according to factory dimensions. If construction must proceed before these data are known, construction of the distributor post must be deferred.

A dosing tank is necessary on practically all filters. Sewage flow may vary from perhaps two or three times the average to one-third or so of the average. Distributors have a flow range of not more than 1:4; some have a narrower range. The dosing tank collects the low flows and, by means of a siphon, discharges the sewage at a rate that will cause the distributor to revolve and dose the filter properly. When spray nozzles are used, a dosing tank is necessary to provide uniform dosing and distribution, since this is accomplished through varying the head on the nozzles. With rotary distributors, a head of 3 or 4 feet will be needed between the high water level in the dosing tank and the surface of the stone. With spray nozzles, a somewhat greater head must be provided. The manufacturer of the equipment to be used should be consulted in order to assure a satisfactory selection and spacing of the nozzles to provide coverage of the filter.

Designing the Filter

General design data on filters were included in the installment of this article which appeared in our June issue, but the information presented there does not permit more than a general approximation of the degree of treatment that will be obtained by any particular design. In addition to the data in the Trickling Filter Handbook, which contains diagrams showing expected BOD reductions, there are other quite satisfactory methods of computing what the result of treatment is likely to be. One method is detailed in the report of the National Research Council Committee on Sewage Treatment at Military Installations, which was publisehd in the September, 1946, issue of *Sewage Works Journal*. Another, which differs in method but usually gives about the same results was published in a booklet issued by the Upper Mississippi Basin Sanitary Engineers. Unfortunately, this publication is not widely available. The Dorr Co. has also developed a formula for results of treatment.

Examples of design for both low rate and high rate filters, using these various methods will be given below. In all cases the following data will be assumed: Flow of sewage, 240,000 gpd; average BOD content of raw sewage, 240 ppm; BOD removal in the primary settling tank, 30%. Total BOD will be 600 lbs., of which 180 lbs. will be removed by primary settling. Loadings on filters will be based on the data published in the June, 1948, issue of this magazine, and will be 400 lbs. of BOD per acre-foot for low rate filters and 3,000 lbs. of BOD per acre-foot for high rate filters. In both cases, these figures represent the loading due to the settled sewage applied to the filters.

NRC Method for Low Rate Filters

Example 1.—Assuming the loading rate of 400 lbs. of BOD per acre-foot, the volume of the filter will be 420/400, or 1.05 acre-feet; and with a depth of 6 ft., the area will be 0.175 acre or 7,623 sq. ft., which will require a filter 99 ft. in diameter. Based on a study of a number of plants, the NRC committee developed a formula for determining the probable efficiency of a filter and clarifier. This formula is: $100/1.0 + 0.0085 \sqrt{L}$, where L is the BOD loading in pounds per acre-foot. For the above condition, where L is 400, the filter efficiency will be 100/1.17, or 85.4%.

Since the removal in the primary tank is 30%, the strength of the applied sewage will be 240(1.00-0.30), or 168 ppm, and the strength of the effluent will be 168(1.00-0.854) or 24.5 ppm BOD.

NRC Method for High Rate Filters

Example 2.—Assume a high rate filter, single stage, with a recirculation ratio R of 1:1, and an applied BOD loading of 3,000 lbs. per acre-foot. The required filter volume will be 420/3,000 or 0.14 acre-foot. With a depth of 4 ft., the area will be 0.035 acre or 1,529 sq. ft., and a filter about 44 ft. in diameter will be required. The recirculation factor F must first be determined from the formula $(1 + R)/(1 + 0.10R)^2$, and when R is 1, F is 1.65. The formula for determining the loading L in the efficiency formula of Example 1, for a filter with recirculation is: L, the applied load (F x filter area in acre-feet). Therefore L is 420/0.14 x 1.65, or 1820. This is substituted in the efficiency formula and E, the efficiency is about 72%. The effluent will contain 168(1.00-0.72) or 47 ppm BOD. The reduction through the plant will be approximately 80%.

Example 3.—Studies by the Upper Mississippi Group show an average reduction of BOD of 63% through a high rate filter and the following clarifier, when the loading on the filter is in the range between 0.2 and 1.0 lb. of BOD per sq. ft. of filter surface per day. By this method, surface area is the criterion and all filters are assumed to be 6 ft. deep. With recirculation, the desired degree of treatment is assumed and the necessary amount of recirculation to obtain this degree of treatment is determined. If an overall BOD reduction of 80% is desired, with an effluent of 48 ppm, (see basic assumptions), the computations will be:

Plant BOD loading	600 lbs.
Residual in effluent	120 lbs.
To be removed by plant	480 lbs.
Removed in primary tank	180 lbs.
Required reduction in filter	300 lbs.

As stated, studies of a number of plants of this type have shown an average removal of 63% of the applied BOD when the loadings on the filter are within certain limits per sq. ft. of filter surface. Since the effluent contains 48 ppm, the strength of the applied sewage to produce this will be 48/(1.00-0.63) or 130 ppm. The BOD of the settled sewage must be reduced from 168 ppm to 130 ppm by recirculation of the filter effluent. The rate of recirculation necessary will be 168-130/130-48 or about 0.46, or 110,000 gpd. The total flow to the filter will be 240,000 + 110,000 or 350,000 gpd.

If a filter loading of 0.45 lb. of BOD per sq. ft. of surface is selected, removal will be approximately 0.45 x 0.63, or 0.28 lb. per sq. ft. The required area will be the applied load, 300 lbs., divided by the removal rate of 0.28 lb., or 1,071 sq. ft. or 0.024 acre. With a 6-ft. depth, the filter will have a diameter of 37 ft. The rate of application should not exceed 30 mgad. The actual rate of application in this case is 350,000/0.024, or 145 mgad; therefore, the area required for rate of loading does not govern the area.

Example 4.—The Dorr Co. employs for single stage high rate filters to determine the strength of the effluent, the formula: Ppm = [0.348 ppm BOD in applied sewage] + [99.4(R + 1)/dosing rate]/0.652 R + 1. Applying this formula to the conditions of Example 2, using a dosing rate of 13.7 mgad, the estimated BOD of the effluent will be about 44 ppm.

Summary

It will be noted that results obtained by these methods vary only slightly and that by using them an excellent approximation of the probable effuent from a trickling filter can be obtained. The same general methods are used in determining probable results from two-stage high rate filters, each stage usually being considered as a separate treatment.

Portable Water Purification Unit Serves Fessenden, N. D.

Fessenden, N.D., which had been hauling water from Harvey, a neighboring community, was blocked off by floods last April. The village officials asked for the loan from the State Health Department of the portable water purification equipment obtained by the Sanitary Engineering Division from war surplus. This equipment was immediately set up on a roadside and placed in operation. Water was handled by a centrifugal pump into three stock-watering tanks; alum was added; and after coagulation and settling, the water was pumped through the filter into the tank truck. Calcium hypochlorite solution was added as the water was pumped to the filter. The rate of operation was but little greater than the usual rapid sand filter rate. J. H. Svore is state sanitary engineer of North Dakota, and this item was reported in the Official Bulletin of the N. D. Water & Sewage Works Conference.

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The Role of Algae in Waste Treatment

A. J. ESPINOSA
Engineer, Texas State Department of Health

ALGAE, those micro-organisms responsible for the green color imparted to stagnant and some slow running waters, are being studied by personnel of the Bureau of Sanitary Engineering, Texas State Health Department. The object of this study is to find the usefulness of these organisms in the oxidation of the unstable organic compounds found in many industrial and all domestic sewage wastes.

The first study was on the behavior of algae with respect to the amount of oxygen which could be produced. Studies similar in nature had been made before in other parts of the United States under various weather conditions. It was our plan to study algae as it behaved under Texas weather. A lagoon situated at Premont, Texas, was chosen and the study begun during the early part of September, 1947. This lagoon received sewage from the town, but due to its shape, Fig. 1, the incoming wastes were channeled through a small part of the lake and the major portion was essentially free of waste.

The sampling point was located about 150 feet from the outfall side of the sewage-algae mixture. Sampling was performed every three hours on a 24-hour basis for six days. Dissolved oxygen determinations were made according to the Rideal-Stewart modification of the Winkler method. It was impossible to get exact values for the dissolved oxygen due to the large amount of bubbling that took place immediately after securing the samples during the daylight hours. At night, no bubbling was noted. The samples were collected in standard BOD bottles and stoppered immediately after collecting. The determinations were made in a mobile laboratory within 5 to 10 minutes after collection of the sample.

The results as found by our determinations are compared to the solubilities at the given temperatures as found in the "Standard Methods for the Examination of Water and Sewage", Ninth Edition.

The accompanying figure indicates the degree of supersaturation afforded by the presence of algae in exposure to sunlight. The results obtained are plotted to show the rhythmic behavior of algae in their production and consumption of oxygen during a 24-hour period.

It is believed possible that the use of algae may be the answer to a cheap method for the treatment of many kinds of wastes. The bright sunshine available during the major part of the year throughout most of Texas is of great advantage to the efficiency of the algae cells in their production of oxygen. The consumption of oxygen by the cells during the hours of darkness could possibly be minimized by the use of artificial light. This has already been advocated by a number of sanitary engineers interested in using algae for waste stabilization. Some industrial wastes which are resistant to oxidation by mechanical methods due to a short period of oxygenation could possibly be left in contact with strongly algae-seeded water for days or weeks and perhaps oxidize aerobically without becoming odorous due to anaerobic action. It will be some time yet before such studies will be performed. This investigation was intended to give us a rough idea of the behavior of algae under the weather conditions prevailing in south Texas.

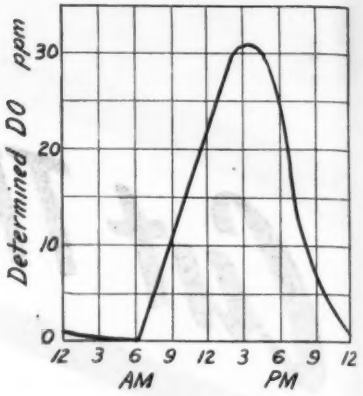

Fig. 1. How the range of determined DO varied with the time of day. This is a composite of all tests.

Symposium on Load Tests of Bearing Capacity of Soils

In recent years load tests to measure the bearing capacity of soil masses have become of increasing importance in engineering practice in spite of wide diversity in test procedure, methods of analysis and application of results in design. The use of this type of test received great impetus in the wartime airfield construction and in the post-war evaluation programs. The publication of the papers presented as a part of this symposium with the report of the Symposium Committee bring together in one reference the most complete compilation of recent information on the subject of Load Tests. This book is well illustrated.

Following the report of the Symposium Committee by Professor W. S. Housel, University of Michigan, are the following papers: "Field Loading Tests for the Evaluation of the Wheel-Load Capacities of Airport Pavements," L. A. Palmer, Bureau of Yards and Docks, Navy Dept.; "Methods of Testing Soils for Runways and Foundations," Elwyn E. Seelye, W. D. Bailey, and S. D. Teetor of Seelye, Stevenson, & Value; "Use of Load Tests in the Design of Flexible Pavements," W. H. Campen and J. R. Smith, of the Omaha Testing Laboratories; "Field Bearing Tests Applied to Pavement Design," Robert R. Philippe, Ohio River Div. Labs., War Dept.; "A Cyclic Load-Test Procedure," Jean E. Hittle and W. H. Goetz of Purdue University; and "A Canadian Investigation of Load Testing Applied to Pavement Design," Norman W. McLeod, Department of Transport, Ottawa, Ont. (the last named is a most extensive paper covering 44 pages.) Twenty pages of the book cover a general discussion by other authorities. There are helpful lists of references, including a general bibliography of over 70 citations. Page size is 6 x 9 in. This book can be procured at $3 per copy from A.S.T.M. Headquarters, 1916 Race St., Philadelphia 3, Pa.

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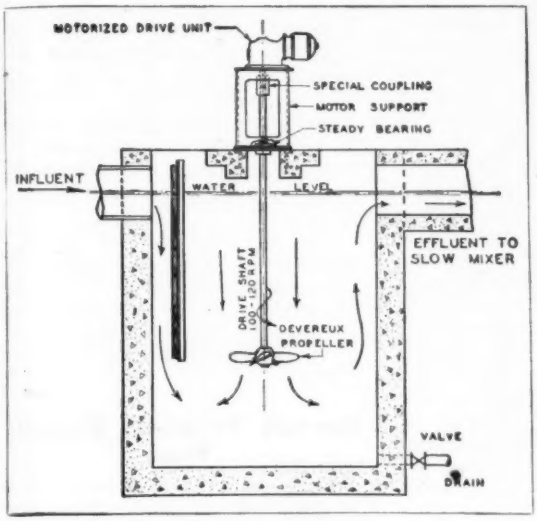

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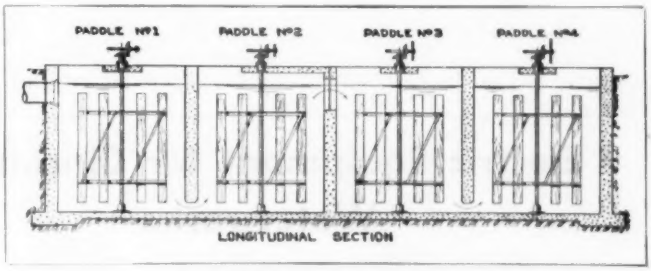
—for rapid and thorough mixing of chemicals with water, sewage or industrial liquids. Large, efficient four-blade propellor operates without under water bearing. Rapid mixing must be followed by efficient, gentle, slow mixing to produce maximum size floc. Vertical or horizontal types of mixers may be used.

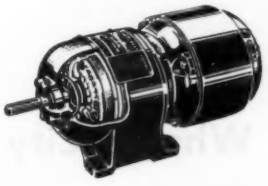


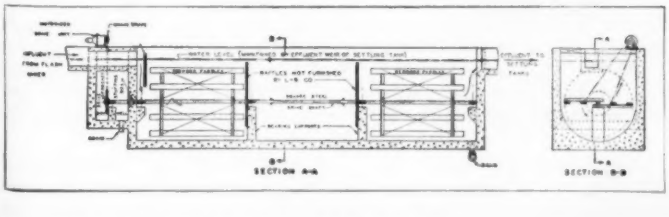
VERTICAL SLOW MIXERS

—for square tanks which can be operated singly or in a series of two, three or four. These mixers will provide efficient mixing and flocculation where vertical flow is desired. The mixers can be operated at a decreasing rate of speed to produce the maximum size floc.

ELECTROFLUID DRIVE

—On slow mixers where the required horse power is one or more, Link-Belt Electrofluid Drives may be used to overcome starting loads and permit the installation of a more efficient motor.





HORIZONTAL SLOW MIXERS

—for rectangular tanks where horizontal flow is desired. The degree of mixing can be reduced as the sewage flows through the tank by decreasing the number and changing the pitch of the paddles.

In addition to chemical mixers, Link-Belt Company manufactures a complete line of equipment for water, sewage and industrial waste treatment, such as Straightline and Circuline sludge collectors, grit collectors and washers, screens, scum breakers, aerators, dryers, power transmitting, elevating and conveying machinery. Send for catalogs.

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Effect of Jet-Driven Airplanes on Airport Runways

A STUDY of the configuration of cones of heat which come from tail pipe nozzles of turbo jet airplanes shows that heat from jet-propelled aircraft will not affect airport runway surfaces. The turbo jet tail pipes, from which the heat of jet type aircraft is emitted, are located sufficiently far above the surface of pavements to cause the heat to be largely dissipated long before it reaches the ground.

By using accurately placed thermocouples to measure the heat at various distances from tail pipe nozzles on jet-propelled aircraft, the temperature has been found to become relatively low as the diameter of cones of heat increase. The heat immediately in rear of the center of tail pipe nozzles is very intense, but it declines quickly from 400°C at that point, cooling to 50°C at a point only two feet above or below the outlet of tail pipes. Horizontally, the heat likewise declines rapidly, being less than 80°C at a point 50 feet in rear of the center of the tail pipe.

Horizontal direction from the jet's outlet is not the critical consideration in the matter of measuring jet-heat which travels parallel to runway surfaces; it is the radial distance from the nozzle in the tail pipe which really counts. The heat declines to 50°C at a point only two feet above or below the center of the cone of heat, and this is relatively far above the surface of airfield pavements.

High velocity blasts of air discharged from jet engines—800 feet per second at the tail pipe nozzle—do present a problem with respect to maintaining unpaved shoulders of runways and take-off areas. The force of jet blasts dislodge unbound particles which compose shoulders close to runways, and frequently destroys turf unless it has become deep-rooted. Paving engineers recognize the need for developing low cost binders to prevent damage to close-by shoulders which results from the unbelievable force of air pressure generated by blasts from jet-propelled aircraft.

These data are from the Airport Division of the American Road Builders Association, of which Division, W. R. Macatee is manager.

Electric Equipment for Cincinnati Waterworks

Electric drive equipment for pumps which will increase the available water supply of Cincinnati, O., by 150 million gallons daily is being built by the General Electric Company. This is the first phase of a five-year multi-million dollar improvement program previously approved by the Cincinnati City Council. The equipment will be installed in the new Tennyson Avenue Pumping Station, which will be built at a cost of over $1,000,000.

Included in the equipment to be installed are three electric motors of 3000 hp. each, designed to drive pumps capable of delivering 25 mgd. to the Eastern Hills system at approximately 200 pounds pressure.

Three other motor-driven pumps, each of 1250 hp. will supply 75 mgd. to the Central Service system of the city at 75 pounds pressure. The Worthington Pump and Machinery Corporation will supply the centrifugal pumps. The new station, to be entirely electrically operated, will be powered by a 13,200-volt distribution system of the Cincinnati Gas and Electric Company built especially for this new station.

Cincinnati's present steam-driven system, begun in 1898 and completed in 1907, now has a capacity of 153 million gallons. It will remain in operation, the new station supplementing the old. The main water supply plant for the city is located 12 miles east of Cincinnati on the Ohio River, where steam and electric-driven pumps lift more than 120,000,000 gallons of raw water daily a distance of 130 feet directly from the river to the settling basins. From the settling basins the water flows through waterwheel generators to the filter plant for treatment. The filtered water flows by gravity from the filter plant through a 22,000-ft. tunnel to the Main Pumping Station. A new 14,000-ft. tunnel will be built to parallel the present tunnel to supply water to the new Tennyson Avenue Station.

The City of Cincinnati uses approximately 93,000,000 gallons of water daily, increasing to more than 110,000,000 gallons daily during hot weather, the maximum rate of use being between 160 to 170 million gallons.

Norfolk Prepares Disaster Plan

To prepare for any national or local disaster that might strike, Norfolk, Va., has started preparation of a disaster plan. To work up the details, City Manager C. A. Harrell appointed a five-man disaster committee, and charged it with the responsibility of constructing a plan that would meet various types of catastrophies. Specifically mentioned were "unusual snowstorms, hurricanes, conflagrations, health epidemics, population evacuations, and major disturbances of any other nature." Close cooperation between the city government, the Navy Department, the American Red Cross, and other agencies will be basic elements of the plan.

What a City Engineer Does

Setting out to determine in what way a city engineer fritters away his time, the Bulletin of the North Dakota Water and Sewage Works Conference, reports an interview with Edward J. Booth, city engineer of Bismarck, N. D. Following are some of the more important activities reported:

The City of Bismarck Engineering Department has drawn plans and specifications and now has under construction 9,423 lineal feet of 8- and 10-inch sewer extensions, 5,295 lineal feet of 6-inch C. I. water main extensions, plus the completion of 3,200 lineal feet of sewer extensions and 3,136 lineal feet of water extensions from last year's projects, or a total of 8,431 feet of water main extensions and 12,623 feet of sewer extensions.

An Improvement District comprising the entire city, except the paved area, has been set up for grading, graveling and placing of culverts for drainage. The Engineering Office has a crew working full time on this project now.

A good sized crew is working on sidewalks, curb and gutter for which the Engineering Office draws all plans, stakes out the jobs, and supervises the work.

The City has let contracts for cleaning approximately 26,000 feet of water main this year by the National Watermain Cleaning Company.

Amongst his small projects, Eddie

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Pittchlor is efficient and economical, easy to use either manually or through relatively simple feeding devices.

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has hired two school boys to paint all hydrants and street markers this summer.

In odd hours, he is working on a solution for their garbage disposal problem. They have on order three new trucks and refuse collectors with compactors.

The City Engineer is responsible for the following jobs, although the engineering and supervision is being done by consulting engineers.

A water project consisting of 42,400 ft. of 8", 10", 12", 16" and 18" watermain; a 500,000 gal. reservoir, and a new pump house. The estimated cost of this project is $541,000.

A paving job consisting of 13 blocks of concrete paving, curb and gutter, sidewalks, storm sewer system, and traffic signals. This project was let on bids at $457,917.30.

A white way system covering the entire business section as well as the Federal Aid Project on Highway 10 through Bismarck.

The Gas Company is putting in mechanical joint couplings on all joints of their mains in the area to be paved.

In addition to these construction projects, Eddie has under his supervision the Street Department, such as street cleaning, repairing and maintenance; the city scales; garbage collection and disposal; and the water supply and distribution system. In the latter case, he says it causes him very little trouble—thanks to Bill Yegen and his crew at the Water Treatment Plant.

Last winter he had a snow removal project of no small proportion, as most of the residents of North Dakota can easily comprehend.

This list of activities does not cover all of the varied things that come up from time to time, but will give some idea of why it is sometimes hard to catch these boys with a spare moment to pass the time of day.

Sewage Treatment by Contact Aeration

(Continued from page 28)

II showing a number of analyses made by the Hays Process Company. These, of course, generally are grab samples as compared to the composites made by representatives of the Health Department. No attempt is made to evaluate the results secured by the Hays Process Company.

Garland.—This plant was designed for a population of about 1,800. The city is at present designing a second plant of this same type to care for the gross overload to the existing plant. Actually only about 7,500 square feet of contact surface should be considered in the first-stage aerator due to the faulty air distribution in one compartment of that stage.

Sheppard Field.—This plant was designed for about 26,000 persons, indicating an overload at the time of the survey of about 8,000 persons. However, liquid loading did not seem to be excessive, since not all the primary sedimentation capacity was in use while this study was being made.

Perrin Field.—This plant was designed for about 2,400 persons and as a consequence was only slightly overloaded at the time of the survey. It is interesting to note that at the beginning of the study only 50 per cent BOD removal was being secured. By separate handling of the digester supernatant liquor, which was exceptionally strong due to digestion trou-

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FOR
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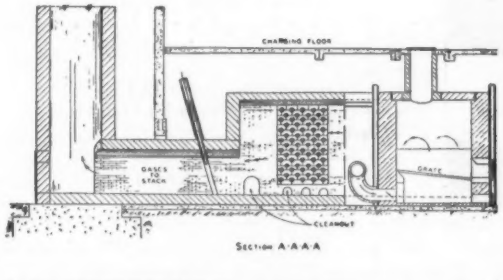

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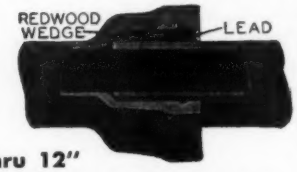

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bles, this figure was raised to 85 per cent in 12 days.

McGregor.—This plant was designed for about 1,600 persons. In this study the composite samples were taken from 8 A.M. to 10 P.M. Suspended solids were not determined. Dissolved oxygen was found in all units following the primary clarifier.

Palacios.—This plant was designed for about 4,500 persons. In this study the composite samples were taken only during the 12 daylight hours. Plate surfaces were not accurately measured but were calculated on the basis of volumes of the areating compartments. Air calculations are approximate only. Tests for dissolved oxygen were not made.

Elgin.—This plant was designed for a loading of about 1,800 persons. The aerators in this installation are filled with rock instead of the asbestos plates used in the other plants considered in this study. Assuming an average rock size of two inches, and a rock surface area of 20 square feet per cubic foot of media, a total rock surface area of 19,400 square feet was estimated. This was assumed as equivalent plate area. Detention time in the aerators was calculated, assuming 50 per cent voids in the rock. Total volume of rock was 971 cubic feet (7,280 gallons). The June, 1945, samples were 24-hour hourly composites. At that time the second-stage aerator did not appear to be working properly. In both studies dissolved oxygen tests were not made. Air consumption was not determined.

Camp Hood.—This plant was designed for about 35,500 persons. Due to faulty meter operation the indicated flows were probably 1/5 to 1/3 more than they should be. Dissolved oxygen was not run on the first-stage effluent. On the second-stage effluent it was zero until the last day of the study when it averaged 0.9 parts per million.

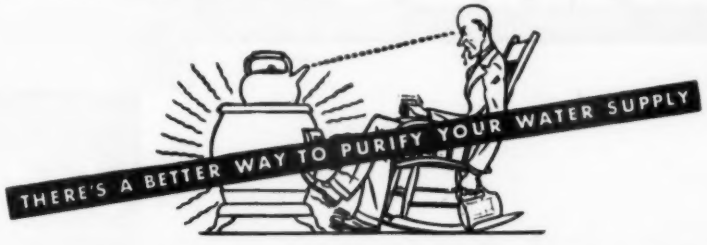
Big Spring.—This plant is designed for about 20,000 persons. Dissolved oxygen determinations were not made. The effluent from this plant is sold to an oil refinery for cooling water.

Evaluation of Data From Table I

No attempt has been made to undertake a detailed analysis of the data summarized in Table I. No doubt the information contained therein could be further studied and evaluated. However, to aid in a superficial analysis, Figure 1 has been prepared to show the correlation between reduction of BOD across both stages of aeration, and total air available per unit of sewage, total aeration period, and plate area per unit of BOD load.

A further superficial examination of these data for each individual stage did not appear to be very productive on first analysis, though some correlation of such factors as plate area versus total air, or total aeration period versus plate area, and resultant effect upon BOD reduction might be obtained. Effect upon settleability of suspended solids could be investigated also.

It should be kept in mind that when these studies were made by the Texas State Department of Health, the primary objective was to observe operating results and attempt to check design bases. For example, air production was generally calculated only on the basis of equipment rating without being checked with an orifice meter or other measuring devices. However, the curves in Figure 1 do not appear to deny the applicability of the design standards employed at the time the plants under consideration were built. It remains for the designing engineers to evaluate the presently employed design criteria, to determine whether different or additional factors should be considered in the design of contact aeration sewage treatment plants.



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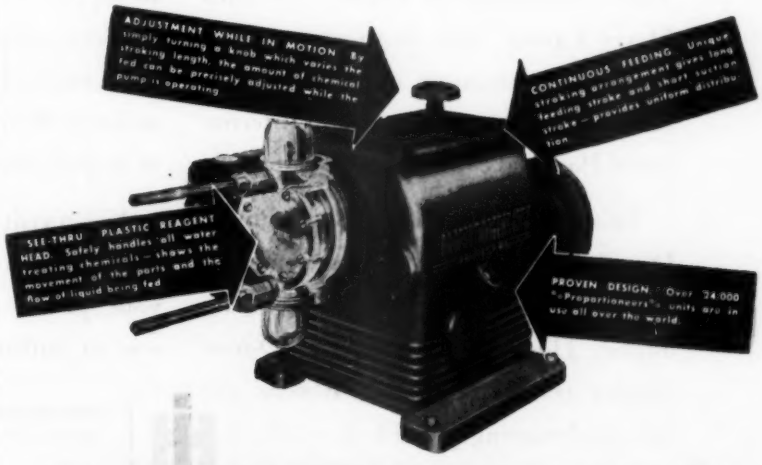
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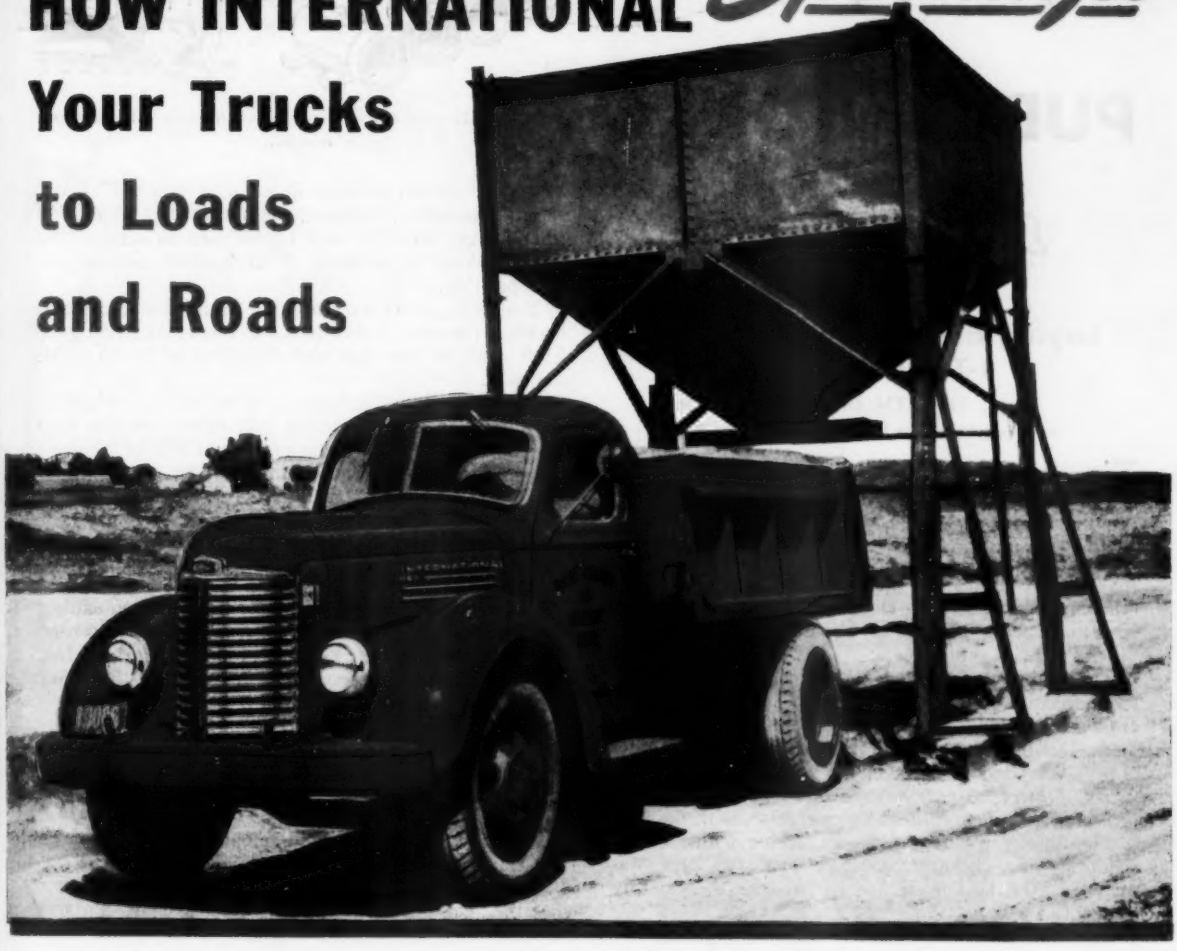

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Engineering Data

Left: How to pile sewer pipe; right, how to unload from a car.

Laying a Water Pipe Under a 4-Track Railroad

J. WARREN LAWRENCE

Manager, West Penn Water Co., McDonald, Pa.

THESE two pictures were taken while an old 8" steel main, crossing under the four tracks of the Pennsylvania Railroad's main line in McDonald, was replaced with new 10" pipe in a 12" casing. The outside diameter of the 10" pipe was 11¼" and the inside diameter of the casing an exact 12", which gave my crew only ¼ of an inch clearance to work with, which isn't much when you are trying to push 70 ft. of 10" pipe.

The casing under the track is located 18 ft. above the transmission main, and a ramp had to be built to cross a creek. This was 12 ft. wide, and up an embankment. As may be seen in the first picture, Mother Nature supplied a "jinpole," to which was attached a "snatch" block to pull out the old pipe and push the new pipe into the casing. This operation, with the help of a bulldozer, required 11 hours. Along with the railroad crossing, 1,000 ft. of 12" cast iron pipe was installed, and tied in at five places with the existing system.

In the 8" steel main which was formerly under the tracks were one 45° and three 90° bends, all of which caused a serious friction loss on a new 16" main, recently installed, reducing the output of a new 1,200 gpm pump. With the new connections in service, the pumping rate is increased about one-half million gallons per day.

The full operation of crossing under the tracks and making the five tie-ins took 30 hours, beginning at 7:30 A.M. of one day and finishing at 10:00 A.M. the next.

As will frequently happen, when you are right in the middle of an important job, other troubles crop up and this project was no exception. While the work was going on, a 10" main broke in our system.

Handling Sewer Pipe Without Accidents or Breakage

A LIST of fifteen safety rules for unloading sewer pipe from railroad freight cars has been compiled by the Clay Sewer Pipe Association, Inc. Four of these cover personal safety, and the other eleven the protection of the pipe.

Personal Safety Procedures

1. In opening the car door, stand to one side. Do not remain in front of the open car door until you *know* the pipe is secure.

2. Sprinkle ashes or sand on any grease, snow or ice (or other slippery place) in the working area.

3. When pipe are secured with metal ties, be sure that the load will not shift when these are cut; and cut at the top of the tie, holding the lower strand with a gloved hand to prevent backlash.

It took 30 hours for this track-crossing job, including five tie-ins, at McDonald, Pa.

4. Remove all debris, such as lumber scraps and cut metal ties from the working area.

Protecting the Pipe

5. Remove securing bulkheads in the car, being careful not to injure the pipe with crow or pinch bars; clear away all scrap lumber.

6. Examine the condition of each pipe-tier before starting to unload it. Shifting of the tiers during transit may require special precautions before unloading.

7. Start unloading from the center of each tier; remove pipe bell-end first to protect bells against damage.

8. When lowering pipe to the floor of the car or to the ground, put it down bell-end first *at an angle*. For large pipe, cushion the floor with an old tire. Keep the pipe from striking bolt heads in the car floor.

9. Do not use a crowbar or other metal tool to pry pipe. For turning a large pipe in a car or truck, place a 4″ x 4″ x 12″ block under the pipe and it will turn easily.

10. When unloading large pipe from tiers or from the car to the ground, provide wooden skids sufficiently long to slide the pipe slowly down the incline, always under full control. Men at the lower end should always work from the side, never in front, of the descending pipe.

11. Clay pipe fittings, such as T and Y branches, should be handled with the spurs uppermost to protect the bells.

12. When transferring pipe from freight car to truck, place the truck so there is no gap between truck platform and car. Never allow truck platform to rest on car floor, as damage to truck may result when it pulls away.

13. Always place boards under pipe when rolling it on the ground, thus protecting the bells.

14. If a car is partly unloaded, brace the pipe remaining in it so that if the car is moved or bumped before unloading is resumed, the pipe cannot shift and break.

15. When storing pipe, always place runner strips under the first row; always block the end pipes. Pipe in the lower row should be so placed that succeeding rows will fit snugly into their valleys.

South Africa's Biggest Airport

The Jan Smuts Airfield, near Kempton Park, 17 miles northeast of Johannesburg will be South Africa's biggest airport and the terminus for airliners from all over the world. It will not be ready for use before 1951; the first stage—earthworks and drainage —will probably be completed by the end of 1948. When completed, it will cover nearly 4,000 acres. The main (N-S) runway will be 10,500 ft. x 200 ft., with "overshoot" strips several hundred yards long. The other two runways will be 8,280 ft. x 200 ft., also with additional "overshoot" strips. All will have a 16-in. crushed rock foundation covered with 4 in. of macadam, and will take planes up to 200 tons in weight. The taxiways will also be macadamized, but the apron area will be concrete. The runways can be duplicated if required, but it is not thought that this will be necessary. A feature of the drainage system is that dotted all over the field are artificial valleys, specially contoured to trap water and hold it within a small area until the deep concrete culverts are able to clear it away. Also planned are a tea garden, restaurant, swimming pool, tennis courts and car park.

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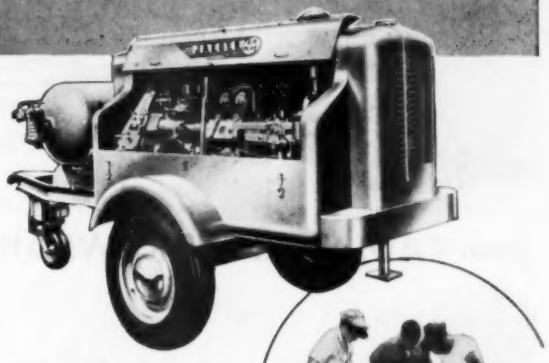

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MODEL 185 cfm runs 3 heavy breakers or medium rock drills at 90 lbs. pressure — which a model 160 can't do.

MODEL 250 cfm runs 4 heavy breakers, 2 heavy drills or medium wagon drill at 90 lbs. pressure — which a model 210 can't do.

MODEL 365 cfm runs a heavy wagon drill plus rock drill or heavy breaker at 90 lbs. pressure — which a model 315 can't do.

MODEL 600 cfm runs 2 heavy wagon drills plus heavy rock drill at 90 lbs. pressure — which a model 500 can't do.

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A new township is being laid out close to the airport, and a new road will shorten the distance from Johannesburg to 13 miles. A brief description of the more important items of construction plant is included. The full description appears in the South African Municipal Magazine, 1947, 31 (363) and this item is from Aerodrome Abstracts, London.

Bid Prices on Dam Construction

The following are estimates and bid prices on some of the items for the Blakely Mountain Dam, Ouachita River, Ark. Bids were opened on 25 March, 1948.

Item	*Unit*	*Estimate*	*Bid #1*	*Bid #2*	*Bid #3*
Clearing	15 A	$363.41	$600.00	$1,300.00	$310.00
Excavation, common ..	185,000 c.y.	.78	2.60	2.00	1.54
Excavation, rock	172,000 c.y.	2.24	2.60	3.50	2.94
Concrete in tunnels ..	30,000 c.y.	19.20	25.00	17.00	25.00
Drilling grout holes	8,900 l.f.	1.77	1.50	2.50	.95
Pressure grouting ..	18,000 c.f.	1.67	4.00	1.30	1.78

The total estimate, based on "fair and reasonable cost," was $3,943,449. There were 6 bidders; the three low bidders, shown in the table above, bid $5,227,443; $4,446,155; and $5,515,242. The high bid was almost exactly twice the estimate.

Operating Equipment in Cold Weather

In Routt County, Colo., county highway equipment was employed last winter on resurfacing work between snow storms. At night, temperatures dropped to 35° below zero. At the end of the day's work, the oil was drained from the FWD truck used on this work, and stored in cans. The trucks were left parked in the open. In the morning, the oil was heated, and the hot oil poured into the trucks. It was found that the engine would start quickly and without trouble or delay when using this procedure. The gravel pit froze every night. To reduce loss of time from this, the gravel was covered at the close of work each day with several inches of dirt to prevent deep freezing; in the morning, the frozen top soil was broken up with dynamite.

Diesel Standby for a Water Plant

THE Hummelstown Water Supply Company, a subsidiary of the Harrisburg Suburban Water Company of Harrisburg, Pa., has the job of supplying 720,000 gpd. of water to the residents of Hummelstown. Not only is the supply used for domestic purposes, but the 3,500 consumers include commercial, industrial and public outlets as well. It is also necessary for the company to maintain 1,300,000 gallons for protection against fires.

The supply is drawn from a creek which also furnishes power for a water turbine when sufficient creek water is available. The company building is situated next to the creek from which the water supply is drawn and is located about 8 miles from Harrisburg.

If at any time the water in the stream recedes to the point where it is too low to enable the company to operate the water wheel which powers the pump, a Caterpillar D8800 diesel electric set is put in operation. The Caterpillar engine was installed December 24, 1946, to operate a Worthington pump in case of emergency, but to date has only been test run—there has not as yet been an emergency at the water company.

PUBLIC WORKS DIGESTS

Sewerage

Water Supply

Highways and Airports

This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of the principal articles, in which the articles in each periodical are numbered consecutively throughout the year, beginning with our January issue.

The letter and number at the end of each item refer to those used in the Bibliography. Numbers not found in the current Bibliography will be found in the one published the previous month.

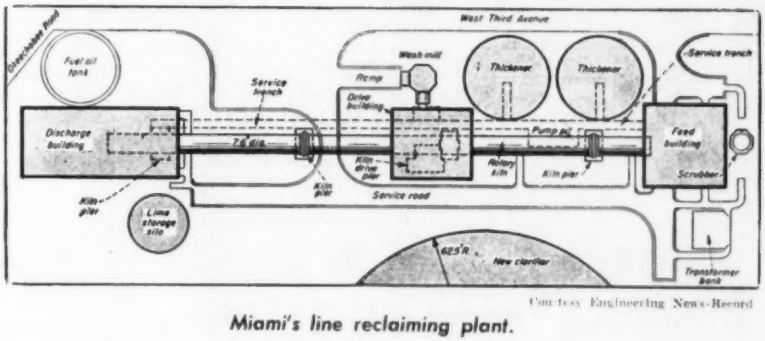
The Water Works Digest

Bacterial Removal by Flocs

The authors investigated the comparative effectiveness of the Spaulding Precipitator and the conventional 4-hour treatment in the removal of bacteria, using both lime and alum treatment. Plants using the two types of treatment were placed side by side and operated simultaneously with the same water and identical chemical treatment, so that the results were definitely comparable. In both the lime-alum process for softening water and the alum-clay process of water clarification, the sludge blanket treatment in one hour removed more bacteria than did the conventional treatment, without a sludge blanket, in four hours.[A60]

Reclaiming Lime Reduces Softening Cost

Miami, Fla., obtains its water supply from wells averaging 80 ft. deep. The water has a total hardness of 260 ppm and calcium hardness of 220 ppm. This is softened to 80 ppm total hardness by adding 1800 lb. of lime per m.g., costing $15.71 per ton in 1947 and $17.83 at present. About 10,320 tons were used in 1947, and 12,000 would have been used if obtainable. To reduce the cost of lime by recovering lime from the sludge the city is installing a plant with a capacity of 80 tons a day from sludge containing 35% moisture. The principal units of the reclaiming plant are: Two sludge thickeners, a wash mill, 3 slurry pumps, a special slurry feeder, a centrifugal filter, a rotary kiln with drive, a cooler, a lime silo, a tower scrubber, an induced draft fan, two CO_2 compressors, a central control panel, a dust collector, 2 sump pumps and a bridge crane. At full plant capacity the fuel consumption will be about 5,100 gpd. The resultant gases will contain 119 tons per day of CO_2, of which 10 tons will be used for recarbonation and the rest will be wasted until construction of a dry ice plant becomes feasible. The cost of the plant will be $550,000. It is estimated that the lime production will cost $9.90 a ton, a saving in lime cost of $7.93 a ton or $94,800 a year, plus income from the sale of about 8,000 tons of surplus lime.[E23]



Courtesy Engineering News-Record

Miami's lime reclaiming plant.

Baltimore's Sampling Methods

In Baltimore, Md., water samples are collected and examined by the State Dept. of Health, the Bureau of Water, and the City Health Dept. The last collected tap samples weekly from 26 fixed sampling stations in fire engine houses prior to 1947, but that year adopted spot sampling rather than set stations. As basis for this, it uses census tracts, established by the Census Bureau so as to have, among other criteria, approximately equal population and homogeneity of population characteristics. The 157 census tracts were divided into 26 areas of 6 tracts each (7 tracts in one area). The tracts in each area are numbered from 1 to 6 and a sample collected each week from like-numbered tracts in all the areas. If any sample shows the presence of coliform organisms another is taken immediately from this and adjacent properties and the cause investigated. It is believed that this method of city-wide sampling will detect promptly any conditions which might affect the sanitary quality of the water in the distribution system.[A61]

Determining Causes of Leaks

It is very important to determine the cause of every leak in a main; not only because it may show how to avoid other leaks, but it furnishes argument for defense in suits for damages that may be brought against the utility by owners of flooded property, or in suits by the utility against others whom it considers responsible for the leak or break in the main. For example, a power company was held responsible for a break caused by laying a concrete-covered duct system directly on the pipe, on which duct the pavement was laid directly.

When damage results from wear and tear, a municipality can not be held liable unless the condition responsible had been brought to its prior notice or had existed for a long enough period to permit it to observe the defect. But if the damage is the result of negligent construction the injured party can recov-

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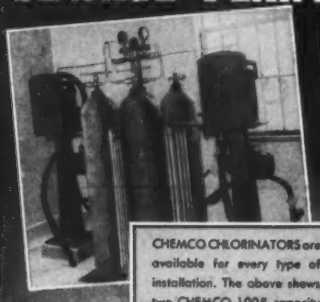

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AGENTS IN PRINCIPAL CITIES

er, regardless of the absence of either actual or constructive notice. The theory of "negligence" always controls. A water utility should keep accurate and comprehensive records enabling it to show in court that it has fulfilled its responsibilities by exercising due care and taking quick action after being notified of defects.

In addition, insurance should be obtained to protect the municipality against personal-injury and property-damage suits. The insurance should start for large amounts, to keep the cost low; the risk of being uninsured against small claims is worth taking because the value of the premiums saved will more than compensate for the lack of insurance in these minor cases.[A56]

Allowance for Water Hammer

Four fundamental relations are essential for a study of the subject of water hammer: 1—Velocity of flow in the pipe line; 2—Length of pipe line; 3—time of valve operation; 4—pressure wave velocity. The amount of surge pressure resulting from stopping any given flow in a pipeline depends upon the diameter, thickness and material of construction of the pipe. Once the flow conditions and size recommendations have been established for a given pipe line, the maximum instantaneous water-hammer pressures above normal can be computed from charts and tables given in this paper. It is especially desirable to adjust the closing time of all valves (including automatic, pressure-regulating, altitude and other valves) so that the time of closing will be long enough to avoid a heavy pressure rise.

For pump discharge lines many other factors must be considered, such as the parting and rejoining of water columns, the effect of the pump and motor characteristics, the inertia of the rotating element, the ratio of the length of line to the head acting on it, and the rate of reversal of flow as compared with the critical time of the line.[A58]

Care of Recording Instruments

Most water works plants contain enough meters and gauges to record the details of the various processes and to serve as checks on each other. The Milwaukee purification plant contains 84 meters to measure rate of water flow and of water discharge, of wash water flow and discharge; elevation of wash water, coagulation, clear well, raw water, and Lake Michigan; temperature of raw and filtered water; pH; filter rate and loss of head; kvh, kwa, volts and amperes, and low voltage and differential relays. All these are calibrated at intervals of time according to a schedule in order to keep the error within that guaranteed—usually 2%. As electricity is used to drive most of these or transmit their results, a well-trained electrical mechanic is employed; or maintenance service can be obtained from the manufacturers of the equipment.

All meters are affected by dirt, dust, rust and foreign particles. An accumulation of dirt and oil will cause more need for calibration than any other single factor. In 95% of the cases little readjustment is necessary but only thorough cleaning and wiping. Activated carbon is found in all parts of the plant and is very abrasive. Dampness causes rust or adhering of dust, and electric lamps have been installed in the cases of some instruments to keep them dry.[A67]

Leak Surveys and Meter Testing Profitable

The village of Glen Ellyn, Ill., with about 2500 active services, in 1937 made a leak survey and found over 100 leaks. This survey cost less than $300, and resulted in saving four times this amount in one year. Since then a leak survey has been made each year. Also in 1937 the meters were taken out, cleaned, repaired and tested, with the result that the revenue was increased by about $6,000 although a 10% cut had been made in the water rates. As later tests showed that meters were underregistering, a meter repairman was employed regularly for removing and testing all meters at intervals of about five years.[F36]

Maintenance of Valves and Hydrants

A gate valve should have a life of 50 yr.—much longer if they receive good care. If the working parts corrode so that it is almost impossible to move a gate, it is moved up and down several times to shear off the foreign substances; this is more effective with parallel-seat than with wedge-type valves. At least once a year each valve should be opened and closed. Difficulty of working a valve is often due to bolting the stuffing box down too tight; a slight leakage at the gland caused by loosening it will generally disappear as water expands the packing. Fire hydrants should be inspected in the late fall and again in the spring of each year.[G30]

Prestressed Concrete Pipe for Montreal

Montreal has installed, to serve as an intake, 9,500 ft. of 84″ pre-stressed concrete pipe made by the Preload Co. in 18 ft. lengths. The walls are 5½″ thick and each pipe weighs about 16 tons. It is reinforced both longitudinally and circumferentially with steel wires. The longitudinal wires were located in the center of the wall, were 0.44″ in diameter, and were stressed to 70,000 p.s.i. in the form before the concrete was poured, which stress was maintained until the concrete had set. The concrete had practically zero slump and well over 4,500 p.s.i. compressive strength at 28 days. It was vibrated internally, and beginning the following day was steam cured for 72 hr. at 90°-100°. Then the circumferential wire was wound on. This was No. 8 gauge with an ultimate strength of

220,000 p.s.i., and was applied with a stress of 150,000 p.s.i. by means of a special machine. Gunite was then shot on to a thickness of about ¼", and the pipe was cured as before. Five percent of the pipes were tested under 50 p.s.i. internal pressure, maintained for 15 minutes without any sign of leakage.[E22]

Protection of Dam Slopes

The covers used for protecting slopes of earth dams include stone riprap, dumped or hand-placed; grouted riprap; concrete slabs or blocks; porous concrete pavement; bituminous pavement; and sod or other vegetable planting. Upstream slope protection should extend from the maximum height to which wave action can reach, to a safe distance below lowest water level. On the down-stream face the destructive effects are generally confined to erosion by rain fall and wind.

The force exerted by waves may be a static pressure, result of kinetic impact of water, impact of floating debris, and upward pressure of water (which has penetrated behind the protecting material) when a wave recedes. The most popular types of slope protection (for large dams) are dumped and hand-placed stone riprap. Where large enough stones are not available, and especially in high-velocity channels, the riprap may be grouted. Concrete pavement may be either slabs or monolithic. The former is not recommended. Where there will be rapid water-surface fluctuations, a drained filter bed should be provided under either class of concrete pavement. The use of porous concrete should be confined to mild climates and where the water is neither heavily contaminated with deleterious chemicals nor deficient in calcium.

Planting on outer slopes may be by seeding, sodding, sprigging (Bermuda grass), or planting vines. Use of vines instead of grass is becoming common, especially on the steeper slopes. Where climate or soil do not favor plant growth, and gravel is available, the latter may afford an economical and desirable protection.[K1]

How Chlorine Reduces Phenolic Taste

Both chlorine and chlorine dioxide are quite effective in reducing phenolic and chlorophenolic tastes; but the mechanism of reaction that causes this has not been clearly settled. After an investigation of this by methods which they describe, the authors report that they indicate that:

(1) The "chlor phenol" taste is caused by a quinone-like substance (possibly dichlor-quinone) which is formed by the oxidation of phenol.

(2) The action of more chlorine oxidant upon the "chlor phenol" (or chlor-quinone) is one of further oxidation with rupture of the benzene ring and the formation of maleic acid rather than complete substitution upon the ring as in penta-chlor-phenol.[G27]

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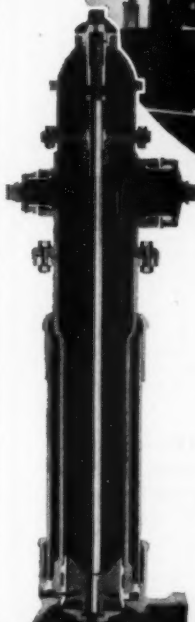

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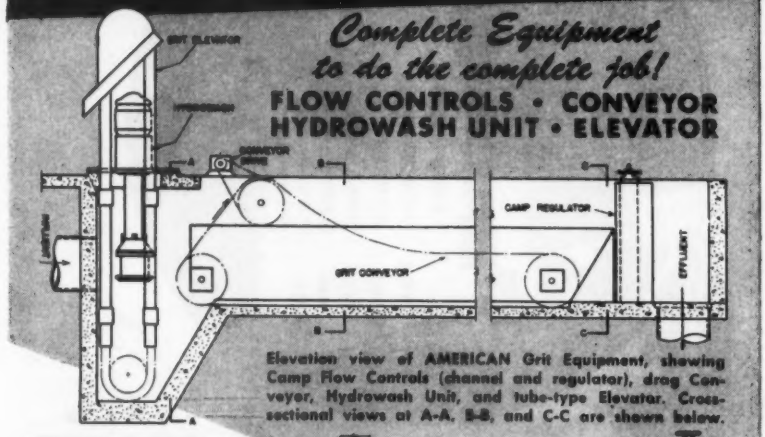

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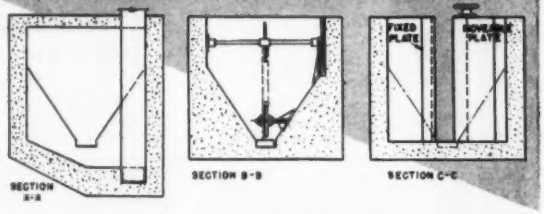

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Laying 4 Miles of Pipe

(Continued from page 29)

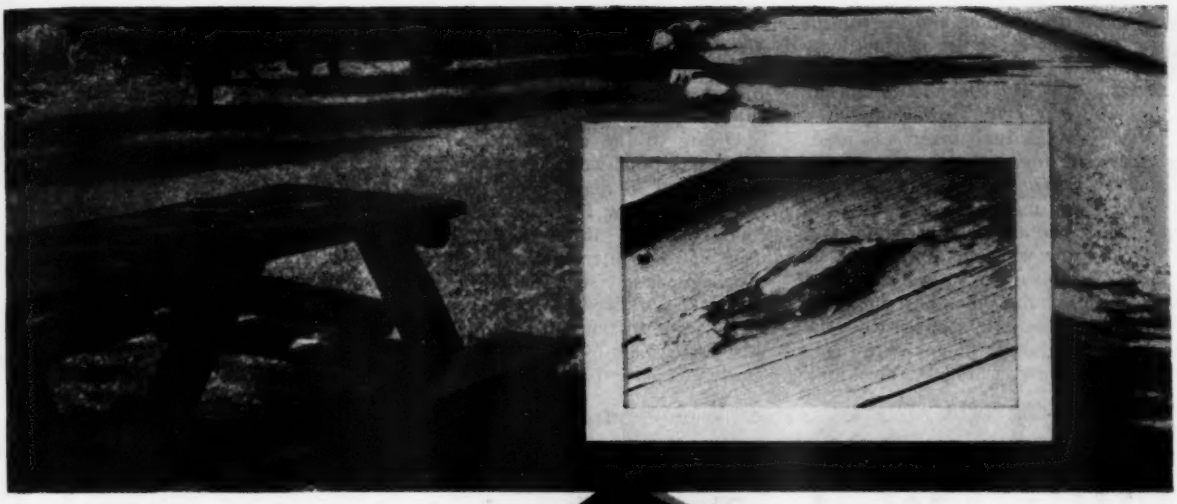
continuously wet, even in dry summer months. It was necessary to use several pumps to keep the trench free from water during pipe laying, and to rush work in this section during the summer, before the beginning of the fall rains which would render trenching practically impossible. A gravel road was built alongside the pipe line for the use of the trucks and other equipment, and heavy wooden platforms were used to support the clamshell cranes while excavating and placing the pipe. Heavy trucks using the road caused the bog to shake like jelly, endangering the cranes. Often work had to be stopped while additional gravel was brought and spread on the roadbed.

The soft trench bottom could not support the pipe adequately and several inches of gravel was spread over it and leveled to an even grade, and workmen then prepared a bed for the pipe to exact line and grade, using for this purpose a semi-circular template.

Laying and Welding the Pipe

As each section of pipe was lowered into place by the crane it was brought into position and fastened temporarily to the pipe already laid by the use of steel pins; then worked into exact alignment and grade with a tolerance of ¼ in. The joint was then tack welded, after which it was welded inside and out and a tar coating painted over the weld. Welding operations were carried out with six Lincoln "Shield Arc" welding machines located at intervals along the working section. Jaeger "Air-Plus" compressors of 60 cfs capacity were used to supply fresh air to the welders working inside the pipe. Backfilling the trench was done mostly by means of hand shovels with some help from bulldozers.

In coping with the problem presented by the creek crossings, the trench was excavated and pipe laid and backfilled up to the creek; then the creek was diverted to cross over



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the completed section, and the trenching continued across its original location. In a few short sections it was necessary to use concrete to anchor the pipe line, for which purpose a Jaeger mobile dual mixer was used.

Two Northwest cranes using clamshell buckts, one 1-yd. and the other ¾-yd., were used for excavating the trench, one in each of two sections of the pipe line which were constructed simultaneously. They were also used for handling the pipe. For pumping water from the trench in the wet section, several Jaeger pumps were used, a Wisconsin and a Marlow. Ford and Mack dump trucks of 3-yd. capacity were used for hauling dirt and gravel. The two bulldozers were D-7 Caterpillars, used for road building, backfilling and other dirt moving.

Owing to the deteriorated condition of the old wood-stave pipe line (which will be abandoned), construction of the new line was rushed to completion all through the heavy rains of the winter season, except for the bog section which was finished before this arrived.

The construction of the pipe line was supervised by W. A. Kunigk, superintendent of the water department.

Water Works Troubles in Manila

Manuel Manosa, Manager of the Manila Metropolitan Water District, recounts the present troubles of his water system in the American Chamber of Commerce Journal. To many of our readers, this abstract will discuss familiar ground.

THE development of Manila's water system began in 1875, during the Spanish regime. Since that time, there have been improvements, development and expansion. In 1940, the Angat-Novaliches project was completed, providing a total of 80 mgd. of water. However, the population of the Manila Metropolitan area has continued to grow and is now estimated at 1,125,000, with 1,200,000 probable in 1950. With a consumption of 75 gpcd., the requirement will be 90 mgd.

A problem in enlarging the capacity of the system lies in the fact that the aqueducts which have been built include 14 tunnels with an 80 mgd. capacity and 13 cut-and-cover aqueducts which carry only 40 mgd. If the latter, which are the present bottlenecks, are enlarged to 100 mgd., the tunnels will then be the bottlenecks. If an entirely new line is built, years will be required for completion, during which time the supply of water will be inadequate.

Distribution System Troubles

Another problem is the necessary general overhauling of the whole distribution system. For many years it has been a fiscal policy to extend water mains on condition that a 10% return is assured. This provision often works out as follows: In a real estate subdivision, when a few houses are constructed, the owners are naturally anxious to have water. Applications are filed, inspections are made, the probable income computed and the pipe size that can be laid for 10% of the expected income is determined. If a 6" main costs too much, the pipe size is reduced to 4", 3", 2" or even smaller to match the potential income. This is the way that much of the distribution system has been expanded, and many of these diminutive and inadequate so-called "mains" now lie under well-paved streets. Moreover, the subdivisions have continued to expand and may now require ten or fifteen times as much water as when the "main" was first laid.

The filter plant, with a capacity of about 50 mgd., has been operated at a 70-mgd. rate; but consumption is 80 mgd., and the excess 10 mgd. have been by-passed raw, but chlorinated heavily to compensate for lack of filtration. Today a filter plant of 100 mgd. capacity is needed.

The main in the upper stretch of the distribution network, supplying 80% of the consumers, and about 2 kilometers long, is of concrete. Earth tremors, vibration from heavy traffic and perhaps the effects of the battle in Manila have caused cracks. Repair is exceedingly difficult, as the water cannot be turned off long enough (about 2 weeks) to permit repairs from the inside, so that outside repairs, such as lead-wool caulking, patching, and placement of collars have been necessary to reduce leakage.

Higher costs have also brought problems. Among these are the demands of laborers for more benefits and privileges and higher wages; the feeling of the poorer groups that they should receive free water service; the high cost of materials and equipment; lower income of the district; low salaries; lack of technical assistance; and many related details.

Rehabilitation Plans

To rehabilitate the water and sewerage systems, including immediate improvements and the completion of two long-range 5-year plans, will require some 42 million pesos, of which 17 million pesos will be needed for reconditioning the water system. This sum is probably beyond the power of the Metropolitan District to furnish; and the deficiencies are of such magnitude that time as well as money will be required to deal with them. The time factor is as harassing as the money factor.

Consideration is being given to the building of a new capital ctiy on a high place not far from Manila. If this project should be carried out and finances were provided for a new supplementary water system, a solution might be possible through a combination of the two systems. In the meantime, the following remedial projects have been approved and some are in process of execution:

1. The return of the Montalban system, built in 1909, to the control of the District and its development to supplement the water supply of neighboring towns. This system had an original capacity of about 10 mgd.

2. With reparation assets available from Japan to construct a small hydroelectric plant to help Balara Filters (a) to produce ferric chloride and use it as a coagulant to remove the impurities in the raw water; (b) to produce chlorine for the disinfection of filtered water; and (c) to lower cost of electricity.

3. Decentralize administration to 12 subdistricts, adopt a monthly instead of quarterly billing system, and supply poor people with running water at 2 centavos a day.

4. Construction of a parallel aqueduct from Balara Filters to the San Juan Reservoir (already started).

5. In combination with the office of "Soil Conservation Service," initiate a project of reforestation and soil conservation for the Novaliches watershed.

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...WOVEN into the fabric of America's great steel industry are many fine Layne Well Water Systems. They are more than qualified in capacity and quality to produce all the water needed for Steel Mill use; cooling, cleansing, waste dispersal, drinking, bathing, fire, etc. Their rugged construction gives years of low upkeep service.

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It is a well known fact that Layne Well Water Systems are built to the very highest standards. They are installed exclusively by the Layne Organization Affiliated Companies—and according to Layne's exacting specifications.

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Layne is a world-wide organization long specialized in developing ground water in large quantities at low production cost. Service is complete from the location of water to the final testing and delivery of the Systems in operation. For catalogs and literature, address

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Pollution Research by National Council for Stream Improvement

DURING the past two or three years a number of papers have been read before technical societies and articles have appeared in technical magazines describing investigations being carried out by this organization; but probably few realize the importance and extent of the work it is doing. The organization is supported by 183 companies operating pulp, paper and paperboard industries. Its functions are "to conduct research looking to the solution of the industry's waste abatement and utilization problems, to make research findings applicable to actual mill operations, and to assist members in applying remedial measures developed in the laboratory."

The sound value of the work being done and the reliability of the conclusions reached are attested by the research personnel employed in various capacities by the Council, headed by its technical advisor, Harry W. Gehm. They include 61 sanitary engineers, chemists, chemical engineers, biologists, bacteriologists, civil engineers and stream sanitation experts. Much of the research work is done through research fellowships by arrangement with eleven colleges and institutes, with two to twelve investigators in each. These, with the leading representative in each, are as follows:

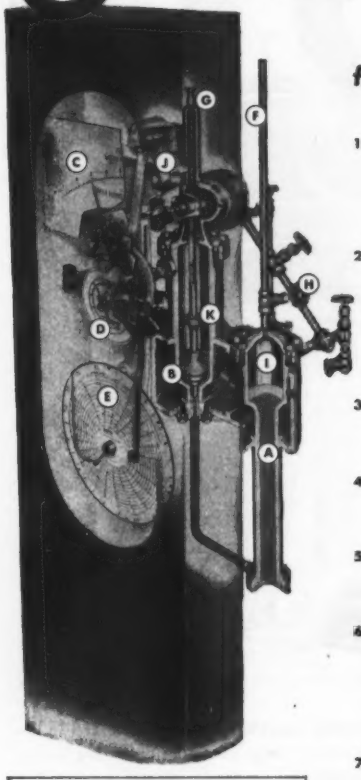
Mellon Institute of Industrial Research—Dr. George D. Beal. Rutgers University—Dr. Willem Rudolfs (white water project). University of Michigan—Dr. G. M. Ridenour (deinking mill waste treatment). Purdue University — Prof. Don E. Bloodgood (strawboard waste). Manhattan College—Prof. C. J. Velz (stream analysis). Oregon State College—Dean G. W. Gleeson (yeast production from waste sulfite liquor; aquatic biology). Institute of Paper Chemistry—Dr. Willis M. Van Horn (aquatic biology project). Louisiana State University — William A. Moggio (kraft mill waste project). Virginia Polytechnic Institute—Prof. F. C. Vilbrandt (semi-chemical pulping waste). Kalamazoo College—Philip F. Morgan (deinking mill waste treatment). Bates College—Dr. Walter A. Lawrence (stream oxidation of sulfite waste liquor and odor control).

8 GOOD REASONS!

Why Builders Type M Meter Instrument is

THE BEST BUY

for Water and Sewage Works



1. HEAVY-DUTY "POWER PLANT":
Large wells containing 35 lbs. of mercury (A) and a solid float of 10¼ sq. in. area having a vertical travel of 4½" (B) provide the reserve power necessary for years of super-sensitive, accurate, and trouble-free operation.

2. EASY-TO-READ DIALS:
Separate Indicator 10" long, uniformly-spaced, direct-reading graduations (C); direct-reading Totalizer: 6 dials, largest dial 3½" dia. with fast-moving hand for precision reading (D); uniformly-spaced, direct-reading Blueline Charts 12" nominal dia. for correct perspective and equal ease and accuracy of readings at low and high rates of flow (E).

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Accuracy of registration easily and quickly checked in the field by means of built-in water head test pipe (F).

4. UNAFFECTED BY TRAPPED AIR:
Trapped air has no effect on accuracy; air easily removed through a valve at the top of each well (G and H).

5. MEEHANITE IRON:
Mercury wells (I), main bracket on which mechanism and wells are mounted (J), and float (B) are high-tensile MEEHANITE iron.

6. HIGH ACCURACY — WIDE RANGE:
Registration with plus or minus 1% (response to differential induced by actual flow rate) over range of 100% to 6½% capacity for Model MDUA; within plus or minus ½% from 100% to 50% and within plus or minus 1% from 50% to 5% of capacity for Model MDUAX.

7. POSITIVE OVERLOAD CHECK:
Check valve (K) prevents loss of mercury even at extreme overload differentials.

8. LONG LIFE:
Type M Instruments installed over thirty-five years ago are still "going strong"!

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Soil Cement Processing Methods

This is a 32-page booklet which covers in a non-technical manner the processing of soil cement with a Seaman Pulvi-Mixer. It is intended primarily for the man on the job but applies as well to the contractor, the engineer and as a ready reference on processing. It tells how to reduce mixing time and evaporation losses; the discussion of mixing is followed by a brief summation of approved methods of compaction and finishing. Sent on request to Seaman Motors, Inc., 305 N. 25th St., Milwaukee, Wisc.

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FOR GREATER CLEANLINESS AND BETTER HEALTH . . .

FOR MUCH LOWER GARBAGE & RUBBISH COLLECTION COSTS

Protect the health of your community with the Gar Wood Load-Packer. Do away with rats, flies and other vermin-carrying pests that spread disease and start epidemics. Modernize your collection system with the *only* fully enclosed sanitary refuse unit that really prevents bacteria-laden garbage from slopping into the streets. Eliminate the old, offensive open type garbage and rubbish collection trucks. Help build a health record of which your city can be *proud*. Win the praise of doctors and householders everywhere with the Gar Wood Load-Packer.

Costs go down too! Hydraulic compressing action allows for greater loads and fewer trips to the dump or incinerator. Results in big savings in gasoline, oil, tires and maintenance.

Low loading height allows faster, easier loading while reducing fatigue and eliminating risk of injuries to the operator. It's easy to operate with push button control.

Write for completely illustrated folder on how the Gar Wood Load-Packer will reduce disease in your community and save money at the same time.

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What users say!...

"It removes virtually all of the fly annoyance which was attendant to garbage collection."

•

"They have cut our cost approximately 35% and at the same time rendered a much better service as far as sanitation is concerned."

•

"Savings in cost of operation are sufficient to pay for the equipment (4 Load-Packers) in 12 months time."

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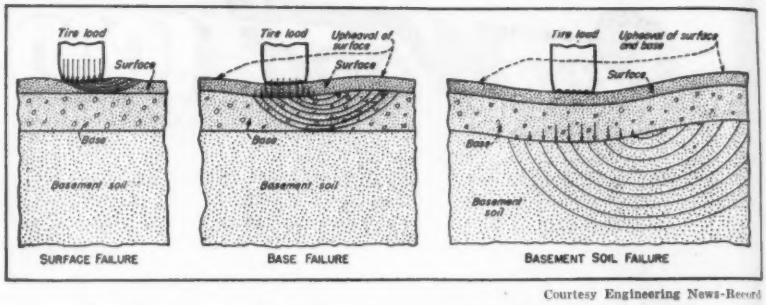
When you need special information—consult the READERS' SERVICE DEPT. *on pages 77-81*

The Highway and Airport Digest

A New Approach For Pavement Design

The California Division of Highways is studying a new method for evaluating soils and calculating the thickness of pavement and base required over any type of soil to support loads on pneumatic tires. This procedure rests on the premise that pavements and bases are effective in supporting loads chiefly because of the surcharge effect; that a load transferred through a layer of bituminous surface or crusher-run base may or may not be spread over the underlying layer or subgrade, but that the most important aspect is the tendency for particles in any layer to be displaced along a curved path, and thus develop an upward thrust against the underside of the base or surface layer. In designing the thickness of pavement necessary to support given traffic loads, there must be considered three primary factors—the unit resistance against displacement of the natural soil; the cumulative destructive or deforming effect of the wheel loads that will pass over it; and the slab strength or tensile strength of the pavement and base. The author describes how to estimate values for each of these, and from them to calculate the necessary combined thickness of all layers above the soil. The procedure is now being used on a trial basis by the Div. of Highways.[E24]



Courtesy Engineering News-Record

The theory on which is based pavement thickness calculations.

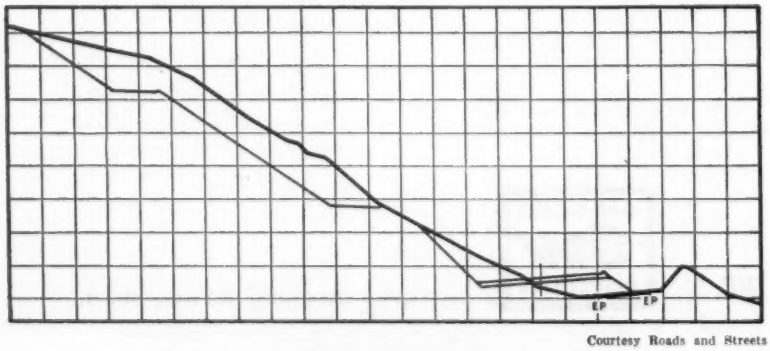
Winter Street Safety in East Orange

East Orange, N. J., keeps its streets completely snow free at a cost of 0.004 ct. per sq. yd. for every snow and ice storm, this including the cost of rock salt, depreciation on spreading equipment, and labor of unloading, storing, reloading and spreading. Rock salt is stored in a rented silo during the winter, and there are 100 boxes of salt-sand mixture on hills for use by motorists. As soon as snow or freezing rain begins to fall, the city begins spreading salt on 15 miles of main arteries and 493 intersections. When the snow fall exceeds three inches, the streets are plowed. Rock salt alone does a better, cleaner and cheaper job than if mixed with cinders.[P32]

2.4 Million Yards of Roadway Excavation

California's heaviest road job this year is the widening and otherwise improving of 8 miles of U.S. 99 north of Los Angeles. This 3-lane road is being widened to 72 ft., with four 12-ft. divided lanes and two 9-ft. paved shoulders, curves flattened to a minimum of 1,500 ft. radius, deep cuts widened and benched to prevent slides, fills widened and with depths up to 453 ft. Old fills known to have high moisture content and low safety factor against slides were investigated by taking core samples and moisture tests and studying the geology. All fills are benched before widening, at least 4 ft. of earth being removed. Natural ground under new fills is blanketed with at least 2 ft. of porous sand. Earth is rolled in 8" lifts and rock in 2 ft. lifts, compaction to 90% relative density being required; earth within 30" of profile grade being compacted in 4" layers. To provide water for moistening the embankment, the contractor laid 8 miles of 6" pipe fed by four 350 gpm pumps. For culverts, 15,000 ft. of corrugated metal pipe 12" to 84" diameter is being used. Curves are widened on the inner side, necessitating excavating up to 450,000 cu. yd. for a single cut. Embankments are covered with 6" of pervious sand followed by 8" of crushed rock and binder. The subgrade is untreated crusher-run rock. The surface is 4" of asphaltic plant-mixed material between bituminous curbs.

The contractor's equipment includes 3 power shovels, 13 scrapers, 30 trucks, 28 tractors, 5 sheepsfoot rollers, 2 pneumatic rollers, 2 steel rollers, 4 sprinkling trucks, 5 compressors, 3 wagon drills and numerous jackhammers, a portable crushing plant, a 4,000-lb. hot-mix plant, and 2 Barber-Greene finishers.[N51]

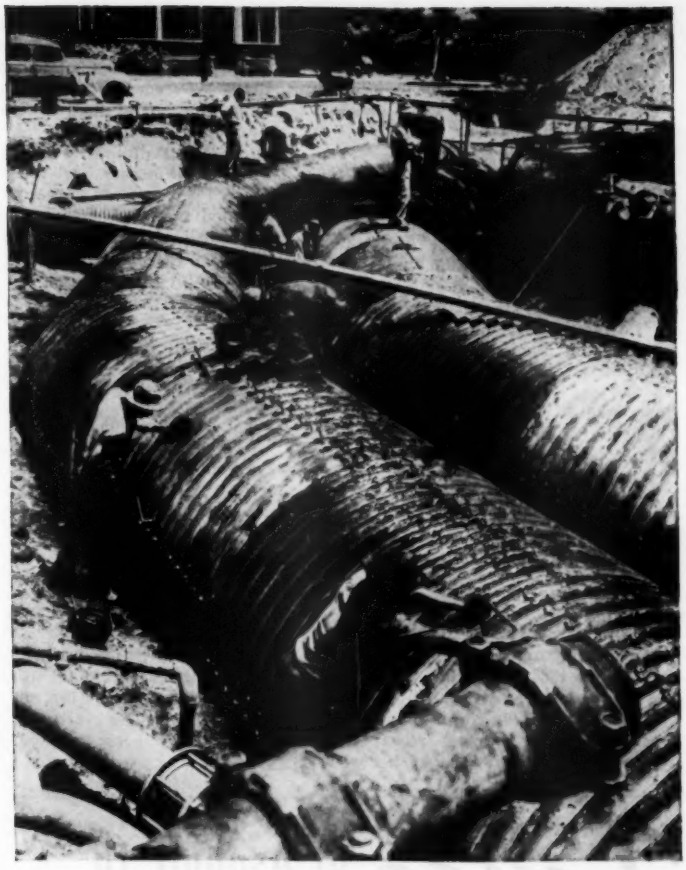


Courtesy Roads and Streets

Typical cut and fill sections showing terracing.

Construction on Houston Expressway

The Houston, Texas, interurban expressway is a 3.6 mi. superhighway running S.E. from the business district. Where built at ground level the topsoil is removed, the subgrade compacted to 100% Proctor density with sheepsfoot rollers for a depth of 6", then covered with a 9" sand-stabilized shell base course, which is sealed with asphalt on which an 8" concrete pavement is laid. Embankments are constructed by removing top soil and compacting, shooting the subgrade with 1 gal. per sq. yd. of 0A55 asphalt, compacting the fill to 100% Proctor, and giving the same asphalt treatment to the sides and top of the embankment. Five overpasses are constructed with 7-column concrete bents supporting a concrete cap upon which twelve 36" steel beams are carried. The columns extend 6 to 40 ft. below the surface, and are 30" in diameter, flaring to 7'6" at the bottom of a conical base 4'10" high. The contractor bores a 30" hole to the full depth by means of an earth drill; then drops into it an under-cutter which has two blades that are opened so as to ream out the opening for the conical-shaped base, the blades then being closed and the undercutter raised, bringing the earth with it. In a few cases



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Costs are high and budgets won't stretch; yet you may be pleasantly surprised to see how far you can make those dollars go with Armco Drainage Products. At the same time you can stick to your determination of using the very best materials in the interest of public safety and economy.

Many cities have found ARMCO Corrugated Metal Products an especially wise choice when faced with the problem of building sewers, culverts, stream enclosures, bridges and other drainage structures at reasonable cost. This is why:

All ARMCO Corrugated Metal Structures have a high strength to weight ratio. Transportation costs are low. They are easily handled and installed by unskilled workmen. Less time is needed to finish the job. Labor costs are low.

Material costs are low because you choose exactly what you need in a wide range of sizes from 6-inch round pipe to a 24-foot MULTI-PLATE Arch. For severe corrosion there is ASBESTOS-BONDED Pipe, while a PAVED-INVERT will guard against erosion. And either standard Corrugated PIPE-ARCH or MULTI-PLATE PIPE-ARCH is just the thing for limited headroom.

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where the holes caved in, they were re-bored inside a steel casing to the top of the base; then a man at the bottom of the casing drove 1" steel bars 6" apart at the proper slope to form a protecting cage inside which he could excavate for the base by hand.[S3]

Road Construction On Loose Sand

In constructing a road in Florida on porous, loose, clean sand that has a bearing value of only 8 lb. per sq. in., stabilizing was the only solution. After grading, the roadway was stabilized 12" deep with crushed limestone and muck or clay thoroughly mixed with a Pulvi-mixer. Steel forms were set and the surface shaped with a subgrader. Then two 4" layers of lime rock were placed, shaped and sealed with tar primer and covered with a retread course of lime rock mixed with asphalt. The sand from edge of pavement to right-of-way lines was covered with 4" of muck mixed with 4" of sand and planted with Bermuda grass.[S5]

Subbase of Cement-Stabilized Sandstone

A section of Montecito Parkway, near Santa Barbara, Calif., which carries from ten to fourteen thousand vehicles daily on a 3-lane pavement, has recently been widened into a 4-lane divided highway with a 26 ft. curbed central division strip. The nature of the soil necessitated a 12" subbase of imported material, 9" of base and 3" of asphalt concrete. The subbase was made of cement-stabilized soft sandstone. Test of a short section showed a bearing ratio of 42% for this sandstone if unstabilized, 78% if stabilized with 0.5% cement, and 112% if mixed with 1% cement; and the last was adopted for the construction. In construction, the sandstone was windrowed and rocks exceeding 2½" in size were broken up by flattening the windrows and rolling with a 12-ton roller. The windrows were then reshaped, the specified amount of cement distributed along the tops of the windrows by hand, and mixed by one pass with a road mixing machine which at the same time added enough water to give 10% to 11% moisture to the mixture. The material was then spread to 4" layers with a motor grader and rolled with a 12-ton roller.[W9]

The Washington-Baltimore Parkway

To relieve the densely traveled Washington-Baltimore Boulevard, there is under construction a parkway 30 miles long on a parallel location. Modern dual highway design with the north and south roadways separated by a median strip varying from 15 to 400 ft. wide will provide for a speed of 75 mph. Curves are used freely to adjust alignment to topography and reduce property damages, the maximum curvature being 2° 30', and all over 1° spiraled. The maximum grade is 3% except at one point where 4% is approached. Three 12 ft. traffic lanes in each direction are being graded but only two are being paved initially. Shoulders are 10 ft. wide to the point where rounding begins. Nine highway-crossing structures provide access to the parkway, in addition to which there are two crossings of railroads, two of rivers, and five structures at local roads. The right-of-way includes 832 acres obtained from 149 private owners at a cost of $415,000.[L15]

Cost of Patching And Subsealing

Pennsylvania last year repaired 11.6 miles of 9"-7"-9" concrete pavement that had been badly punished by war traffic, by removing disentegrated pavement and replacing with new concrete, and by subsealing 79,477 sq. yd. with asphalt. In removing the concrete, a foreman and 10 to 18 laborers, with a pavement breaker, a compressor and a truck, broke up and removed 1928.5 sq. yd. in 45 days at a cost of $8,995.36 or $4.67 per sq. yd. The new concrete patches were made 10" thick, with ready-mixed concrete hauled 7 miles, at a cost of $5.49 per sq. yd.

For subsealing, 6,394 holes were drilled at a cost of $1,427.34, and through them was pumped 111,586 gal. of 30-45 penetration blown asphalt cement which cost 12 ct. per gal. on the job, giving an average of 20 ct. per sq. yd. of subsealed pavement.[N52]

Electrical Stabilization of Soil

There are many possible methods of using electricity in stabilizing soil. When soil and water are mixed the soil takes on a negative charge and the water a positive charge. If a voltage is applied between two electrodes in the mixture, the soil is attracted by the anode and the water by the cathode. In one case where a fill had been constructed with an excess of water, this method reduced the moisture content from 24-26% to 14-17%. In another case, two piles 6 ft. apart covered with sheet aluminum were used as electrodes, driven 20 ft. into soft clay. At first the skin friction was 250 lb. per sq. ft. but after applying 110 v, 25 amp. current for 11 hr. the friction of both piles was increased to 1,250 lb. The cost of such treatment is high but in certain projects this may be less important than the securing of the result.[N53]

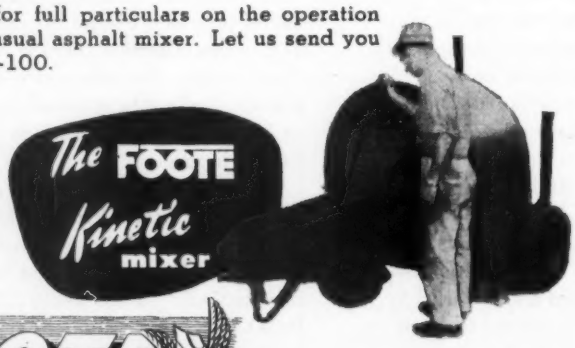
Maintaining Connecticut's Highway Equipment

For maintaining 4,000 miles of state roads the Connecticut Highway Dept. has 11 district maintenance garages, which care for most of the equipment needs, while a machine shop in Portland does the more serious repair work. The department owns 180 passenger

3 CU. FT. of Asphalt in 30 seconds

Think what that means on those patching jobs! Fast operation, easy transportation from job to job (just tow it back of a truck or car) and an unusual mixing principle introduces a new economy to maintenance work on streets, roadways, walks, parking areas, floors and asphalt waterproofing jobs.

Write for full particulars on the operation of this unusual asphalt mixer. Let us send you Bulletin K-100.



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cars, 700 trucks, 17 oil distributors, 9 trucks with eductors, 9 graders, 2 power shovels, 12 road rollers, 36 water pumps, 30 concrete mixers, 7 compressors, 3 Calyx drills, 60 power mowers, 36 tractor-type mowers, 8 power sprayers, 100 loaders, 400 sand spreaders, and 3 mud jack pumps.

Each repair shop is equipped with lathes, power hack saws, a drill press, power grinder, 60-ton press, forge, arc welder, acetylene welder, valve refacer, valve reseaters, reamers, 12-ton floor jacks, special pullers, special jacks, and special automotive tools.[N57]

Moving 10,000 Houses

The California Division of Highways has launched a 10-yr. project which anticipates 100 miles of freeways within the Los Angeles Metropolitan area and will involve removing 10,000 buildings and 25,000 people from the right-of-way. After acquiring the title to all the land and improvements in the right of way, the problem was to sell the buildings and get them removed; and incidentally to relocate the tenants. According to the plan developed, the buildings are sold at auction on the spot, the purchaser to provide the tenants of the building with continued housing for a period of six months, which costs about $50 per person. Where the cost of removing the building plus $50 per tenant exceeds the value of the building, the tenants are provided with other houses in which to live and the house is sold without the requirement of providing for the tenants. About 85% of the houses are sold with tenants. In many cases the tenant purchases the house. In a number of cases some readjusting of tenants simplifies matters for the Division; if a house contains so many tenants that the tenant burden makes it unmarketable, enough tenants are removed to other houses to reduce this burden sufficiently. In some way, housing is provided for everyone living in the freeway. A large percentage of those living in houses sold as tenant-occupied choose to sell their rights of continued housing and use the cash to assist them in relocating elsewhere.[W10]

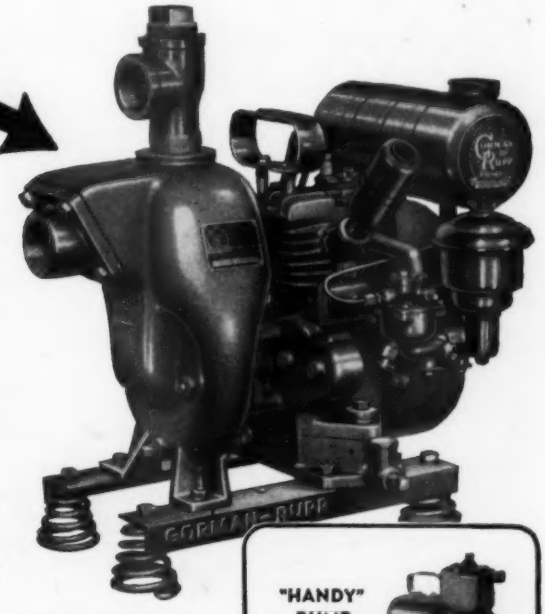
Possible Cuts in Highway Costs

Seven contractors and engineers offer suggestions as to methods by which the cost of highway construction can be cut. Briefly, these are as follows: Greater use of machinery and cooperation of contractors and equipment manufacturers in developing improvements in same. Designing bridge and other structures so that forms can be used over again repeatedly. Greater utilization of local materials. Eliminating unnecessary refinements. Letting work in large contracts. Giving longer time for completion of contract. Giving contractors greater leeway in methods, specifying only the results required. Encouraging small, new and out of the state contractors. Proper maintenance of equipment. Use pipe for culverts up to 72". Eliminate sodding and concrete curbs wherever possible. Standardize mesh reinforcement. Increase competition by limiting work offered to that which is urgent in character, and accept bids only where the unit bid prices are justified by proper engineering analyses. Construct by force account.[E-15-21]

Base Stabilization For Secondary Roads

North Carolina is spending on its secondary roads about 60% of its total highway expenditures. A large part of this is for construction of 6" to 7" stabilized soil base with bituminous surface treatment. The natural soils being stabilized with sand or screenings are primarily clays of the kaolinitic type. The amount of stabilizing material to be added in each case is determined by the department's soils laboratory, being calculated to produce a mixture of which 90% to 100% will pass a No. 10 sieve, 40%-75% a No. 40, and 15%-35% a No. 200. The amount of material added averages about 70% of the 7" of compacted material. The contractor is paid by the ton for stabilizing material, by the sq. yd. for processing and compacting the base, and by the sq. yd. for the surface treatment. In preparing the base, the soil is scarified and then windrowed to the edges of the road, the sand is spread

COSTS LESS to PUMP MORE



The new GORMAN-RUPP Self-Priming, Centrifugal Lightweight Pumps challenge any pump their size and type to equal their performance.

Guaranteed to:

Prime Quickest -- Prime Highest -- Pump Fastest

"Never Quit" on the job -- will not clog -- practically trouble-free. Suction lift 30 ft. guaranteed. (sea level)

Write for Bulletin 7-LW-13

GORMAN-RUPP LIGHTWEIGHTS ARE MADE IN 3 SIZES:

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uniformly over the base, the windrowed material is spread over it and the two mixed with disc harrows and rotary mixers, and compacted with sheepsfoot and pneumatic-tire rollers. Preliminary to adding the surface coat, a prime coat of 0.3 gal. per sq. yd. of hot MC-O asphalt is applied, followed a few days later by 0.4 gal. of 150 to 200 penetration asphalt followed immediately by 42 lb. per sq. yd. of 1" crushed stone or gravel. The combined cost of base and surface treatment has been about $9,600 per mile—about $2,400 less than where soil-cement base is used.[B22]

Aerial Surveys For Highway Location

Studies for locating the proposed extension of the Pennsylvania Turnpike eastward 140 miles to Philadelphia were based upon an aerial survey instead of a ground survey, since qualified men and sufficient time for the latter were not available. Moreover, both the cost and the time required would have been five times greater. Th aerial work was done in the fall of 1947, when there were no leaves on the trees. The Aero Service Corp. contracted to deliver in 145 calendar days topographical maps, scale 1" = 200 ft., with 5 ft. contours and showing all buildings, roads and other features. There were 51 such maps, each 5 ft. to 7 ft. long. Elevations were to check within 2½ ft. with ground surveys. Also prepared were photo mosaics on a scale of 1" = 400 ft., prints from the mapping negatives at 1" = 1,000 ft. and enlargements of them to 1" = 400 ft. The topographic map resulting, as compared with conventional ground topographic surveys, is as accurate, considerably more complete, produced faster, with less risk of human error, and without disclosing the proposed location to land speculators.[E23]

Roadway Amenities

In locating a road, it should not destroy existing natural features but rather open fresh vistas to view, as by aligning a straight length on a church steeple or tree crested hill, or, on the other hand, suddenly disclosing a striking view by curvature of the road. In alignment, long tangents are monotonous and fatiguing to the motorist; sudden changes of line or grade should be avoided; curves of markedly different radius succeeding each other in the same direction give an unpleasant effect; transition curves are more pleasing than abrupt change from tangent to curve; a combination of vertical and horizontal curves may produce undesirable effects; super-elevation of curves improves the appearance; the alignment should in general conform to the contours—a straight road along a meandering stream is unpleasing to the eye. Embankments and cuts should not adhere too rigidly to standard slopes, and tops of cuts should be rounded, or softened by planting shrubs. In the case of dual roadways, variety can be obtained by varying the distance between them or their relative levels. Bituminous surfaces harmonize better with rugged and semi-wild country, concrete with highly cultivated rolling country. Hedges are more slightly than fences; in some localities anything except a stone wall would be out of place.[Y7]

Rehabilitating Kansas City's Streets

In 1947, Kansas City, Mo., spent $95,000 in repairing and repaving curbs, sidewalks, and roadways. New sidewalks were made of 4" concrete; new curbs 8" x 20". Where necessary, old curb was refaced with "shotcrete." Sidewalks that needed resurfacing were covered with ¼" of "Plastic Rock," a mixture of emulsified asphalt and aggregate. The roadways, chiefly brick 20 to 30 yr. old, were repaved with asphaltic concrete 2½" to 5" thick. Asphalt surfaces on an 8" concrete base that had become rough were resurfaced by removing 1" with a heater planer and replacing it with asphaltic concrete. Where the curb corners had a 4-ft. radius this was changed to 12-ft. to 15-ft. radius, and a catch basin constructed at each end of the curve. Shot-

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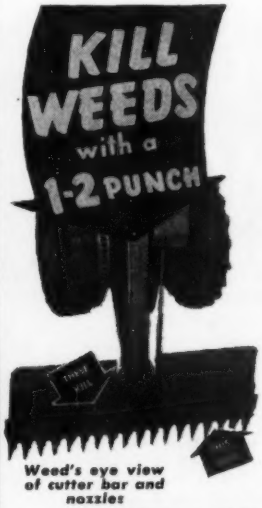

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creting the curb cost $3 a lineal foot; sidewalk resurfacing 60 cts. a sq. ft.; asphaltic concrete $7.67 per ton.[J10]

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16. Three Cost-Cutting Tips from Texas. By D. C. Greer. Pp. 121-122.
17. Cutting Costs in the Midwest. By George C. Koss. Pp. 122-123.
18. Fewer Restrictions on Initiative Will Reduce Road Costs. By Morris E. De Witt. Pp. 123-124.
19. Savings in Costs Result from Encouraging Specialization. By R. C. Keeling. Pp. 124-125.
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21. Lack of Real Competition Results in Higher Bids. By J. S. Bright. Pp. 126-127.
22. Base Stabilization Widely Used on North Carolina Secondary Roads. Pp. 128-129.
23. Aerial Surveys Speed Turnpike Location. By Frank J. Williams. Pp. 131-133.
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9. New York State's Answer to Urban Traffic Problems. By Charles H. Sells. Pp. 72-74.
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51. California's Heaviest Road Job. By Harold J. McKeever. Pp. 49-57.
52. Pennsylvania's Resurface Practice. By Warren K. Myers. Pp. 60-62.
53. Electrical Stabilization of Soil. By E. S. Barber. Pp. 64-65.
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June 30

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Dallas Public Market

Dallas, Texas, has completed construction of another unit of a $3,000,000 public market. The new building is for wholesalers who deal in fresh fruit and vegetables by the carload. Two farmers' produce sheds also have been built. Still to be built are two farmers' sheds, a retail produce dealers' building, and two buildings for small wholesalers for produce truckers.—*Public Management.*

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The Sewerage Digest

Glass-Insulated Sludge Digester

A sludge digestion tank built as part of the treatment plant of Ephrata, Wash., is lined with "Foamglass" for heat insulation. This material has a thermal conductivity coefficient of about 0.40, is completely impenetrable, and nails can be driven into it. It was applied in 12 x 18 x 2 in. blocks nailed to the forms and backed by the concrete walls. After the forms had been removed the entire interior surface was coated with a wax-type hot coating that formed a gas-tight membrane.[E20]

Treatment of Cannery Wastes

The author summarizes general current practice in treating cannery wastes and reaches the following conclusions:

1—Fine screening of waste waters is most important as it is easier and cheaper to dispose of solids as garbage than to be faced with the task of removing excessive volumes of soupy sludge from manually cleaned settling basins.

2—Sedimentation of suspended solids in settling basins reduces the decomposible solids discharged to lagoons, thus reducing the odor potential as well as the demand for expensive nitrate as a stabilizing agent.

3—Lagooning of waste waters without creation of local nuisance is entirely practicable provided a sufficient area is available for lagoons of ample capacity to retain the entire volume of wastes for the operating season.

4—Lagoon embankments must be wide, well compacted, trimmed and maintained by daily patrol.

5—Lagoon capacities can be reduced and cannery operations expanded if ample nearby acreage is available for disposal of wastes by a sprinkler irrigating system.

6—No cannery should be so located as to discharge waste waters to a small stream unless ample adjoining land is available for settling basins and adequate lagoons as there has not yet been developed a practical method for treating cannery waste waters in a compact plant which will dependably produce an effluent of quality to meet present requirements of state agencies controlling stream pollution.[G26]

Treatment of "White Water"

A study of the methods employed for clarifying wastes from paper-board mills showed that either vacuum filters or conventional settling tanks remove about 50% of the suspended matter and less than 25% of the B.O.D. But 2-hr. settling in effective tanks produces as good results as 4 hr. in conventional types of tanks. It is extremely doubtful that mechanical flocculation is of value. About 90% of suspended matter and turbidity is removed by chemical coagulation and settling, but chemical coagulation adds little to B.O.D. removal. Alum supplemented with activated silica is 3 to 20 times as effective in removing turbidity as alum alone. The volume of sludge produced by clarifying one million gallons of average boardmill waste is about 13,000 cu. ft. after 30 minutes settling. Treatment by settling of cooking and bleach liquors separately produced better results than settling of combined wastes in whatever proportions.[G24]

Ground Garbage in Sewage Treatment

Disposal of ground garbage with sewage is practiced in 12 cities. The advantages are: One public utility handles both. It is efficient and sanitary. Revenue can be obtained by additional digester gas and fertilizer. Disadvantages: It introduces problems in operation of a sewage plant. It requires more careful separation of garbage from rubbish, which would probably require considerable education of the public.

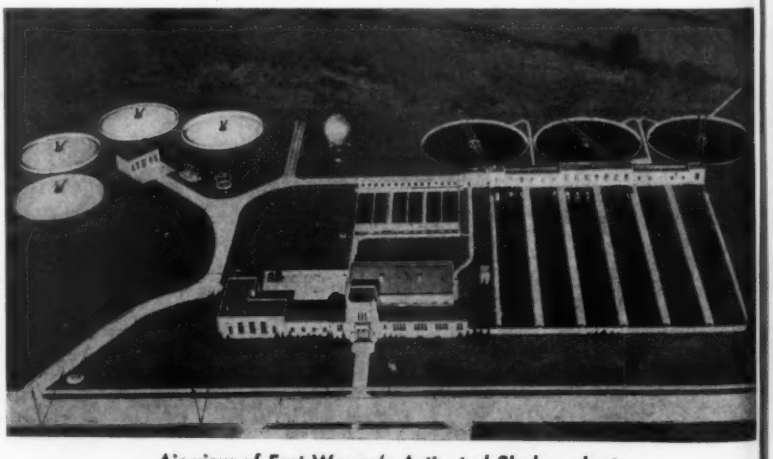
Home garbage grinding units have been installed in some homes in over 300 communities. At least 15 firms make or market electrically operated home grinders at the rate of 200,000 units a year. Berkeley, Calif., prohibits their use. New Jersey's health department advises against them because of increased cost of sewage treatment plants and additional pollution load on the waters of the state. Home grinders cost $90 to $290 each to install, as compared to $6 to $9 a year per family which present disposal methods cost, and the city must still collect rubbish. Their universal use would make it necessary to triple the capacity of sludge-handling facilities and increase considerably the facilities for screening, grit and grease removal.[X18]

Los Angeles Hyperion Project

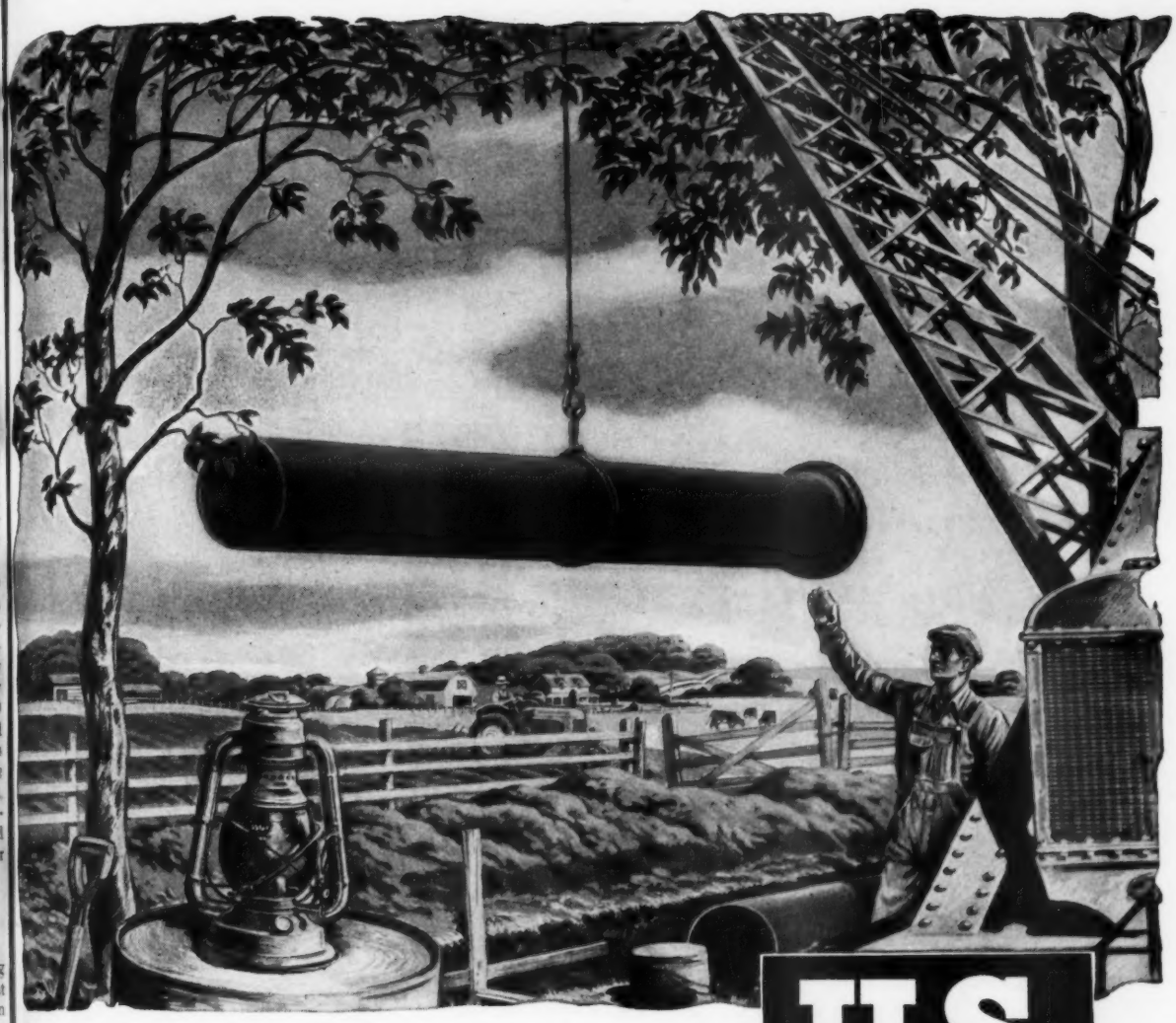
The $41,000,000 Los Angeles sewage disposal project, now well under way, is described in this article. The mile long 144" outfall into the ocean has been completed. The plant will cover an area of 3,200 x 1,200 ft. and is a standard activated sludge plant containing a few unusual details. It will receive sewage from an area of 450 sq. mi. through sewers with a combined capacity of 540 c.f.s. of dry-weather flow. Before primary settling, the raw sewage will be aerated for 30 min. Digester gas will operate nine 1,600 h.p. dual-fuel engines; water jackets will be cooled by the vapor-phase method, the waste heat furnishing low-pressure steam for preheating the raw sludge and maintaining the primary tanks at 100°F. The estimated 200 tons per day of digested sludge, dried to 8% moisture, will be sold as humus fertilizer. In grading the plant site which is situated among sand dunes, 14,000,000 cu. yd. of sand is being removed hydraulically and used to extend the beach seaward 600 to 800 ft. over a distance of 6 miles.[L5]

Twin Sewers In San Leandro

San Leandro, Calif., is completing trunk sewers and a treatment plant made necessary by industrial expansion brought about by World War II. For reasons explained, it was concluded that separate sewers for domestic and for industrial wastes would be economical and possess other advantages, and twin sewers are being laid from the disposal plant to and through the in-



Air view of Fort Wayne's Activated Sludge plant.



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dustrial area, and separate treatment for industrial wastes and domestic sewage is provided in the plant. The twin sewers are laid in the same trench, with only enough space between for backfilling around them. The sewers are of 15" to 36" reinforced, centrifugally cast, tongue-and-groove concrete pipe, laid on a 6" bed of coarse rock placed in the bottom of the trench, and backfilled to the spring line with quarry dust, sand or other available material. At present a trench 6½ ft. wide and with an average depth of 20 ft. is being dug with a Parsons trencher and backfilled with a 4½-ton crawler-type bulldozer, which works on an incline in the trench, pushing an 8" layer of earth down the incline and compacting it as it backs up to the surface again.[P25]

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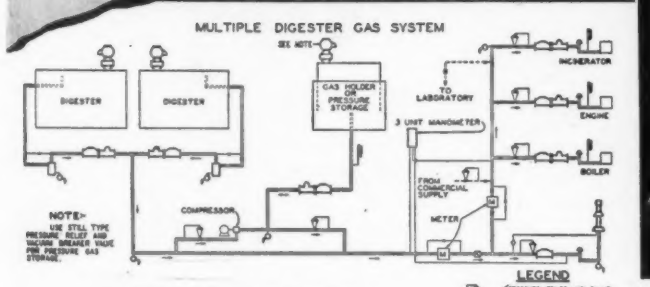
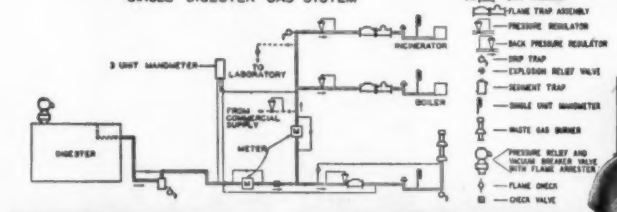
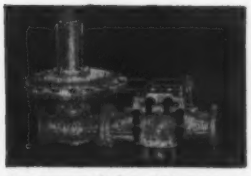


Waste gas burner





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Bibliography on Uses of Highway Planning Survey Data

During the years since the program of State-wide Planning Surveys was inaugurated much valuable information has been collected but in general the problem of effective use has not been fully solved. This annotated and indexed bibliography contains available references on the uses that have been made of planning data. These uses include: (1) Maps to show the state of the existing facility and the traffic service performed. (2) Origin and destination data to show desired directions of traffic flow. (3) Fiscal studies to determine income and requirements for maintenance, replacement and improvement and the proper division of funds between administrative systems. (4) Motor vehicle allocation studies to determine incidence or distribution of the motor-vehicle tax burden and to furnish necessary information for a highway tax policy.

(5) Road use studies to determine the distribution of road use benefits. (6) Road life studies to furnish data essential for the analysis of annual highway costs. (7) The combination of the above and allied data to be used in the determination of economic justification of project priority and in the publication of reports designed for informational purposes.

The bibliography was prepared by the Joint Committee on Uses of Highway Planning Survey Data. The initial draft was compiled by Miss Margaret Ticknor, Assistant Librarian in charge of the Planning Collection. The preliminary draft of the bibliography was distributed to the planning survey sections of the various State Highway Departments and others interested in this phase of highway work, for their comments. The additions received are incorporated in the bibliography.

We believe this bibliography is available from the Highway Research Board, National Research Council, Washington, D.C.

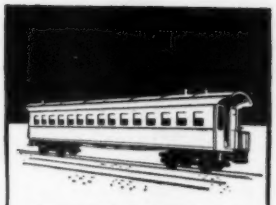
Garbage Grinding

Disposal of ground garbage into the sewerage system either at central locations or at the sewage treatment plant is practiced in 12 cities: Findlay, Ohio; Flint, Lansing, and Midland, Michigan; Fond du Lac, Wisconsin; Gary, Indiana; Goshen, New York; Indianapolis and Marion, Indiana; Lebanon, Pennsylvania; Rock Island, Illinois; and St. Louis, Missouri. Other cities, either considering or building such systems, are Ann Arbor, Benton Harbor, Muskegon, Muskegon Heights, Port Huron, and St. Joseph, Michigan. St. Louis reduced garbage collection costs by placing its grinding station in a central location and avoiding the long haul to a disposal facility beyond the city limits. Findlay, Ohio; Goshen, New York; Lansing, Michigan; and Marion, Indiana; have grinding stations at their sewage treatment plants.—*Public Management.*

Figuring Coagulation Costs

Al Brumley of Alhydro has sent us an ingenious method of figuring coagulation costs for water purification. While this was originally designed to compare costs of chemical coagulation with those of the electrical process, it may be used as a short cut for getting cost data.

The annual cost of coagulant is the product of the average dosage in parts per million of the coagulant, the volume of the water in thousands of gallons per day, the cost per ton



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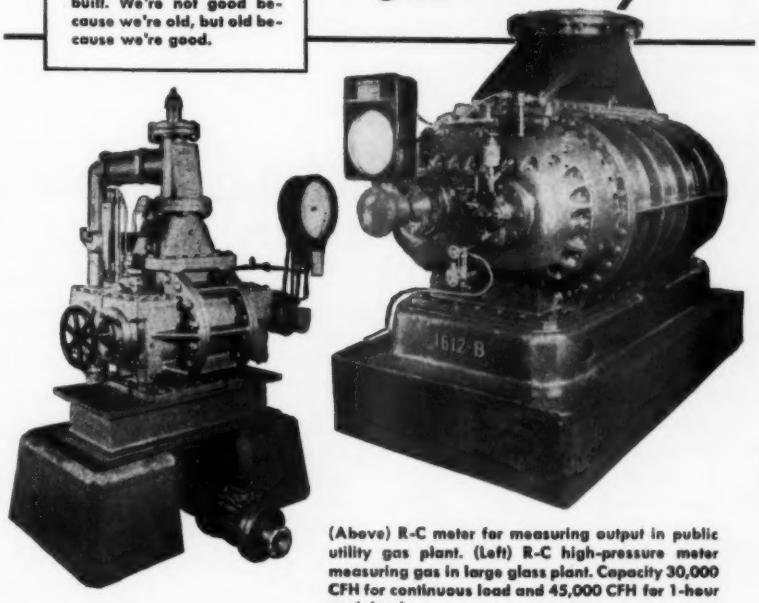

(Above) R-C meter for measuring output in public utility gas plant. (Left) R-C high-pressure meter measuring gas in large glass plant. Capacity 30,000 CFH for continuous load and 45,000 CFH for 1-hour peak load.

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of coagulant, and 0.00152. The cost for added alkalinity is computed on the same basis. Assuming 1 mgd. flow, a dosage of 30 ppm. of coagulant and of 15 ppm. of alkali, the costs per year would be:

30 x 1000 x .00152 x 40=$1,824.00 *for coagulant*
15 x 1000 x .00152 x 12= 273.60 *for alkali*

The total cost would be $2,097.60.

The Alhydro method cost is based on aluminum plates at 40¢ per pound and power at 1¢ per kwh. He assumed a dosage of 30 ppm. of alum is required, which is to be furnished by the electrolysis of the aluminum plates. With this method, it is stated, no alkali is required. The aluminum cost is: Ppm. required X thousands of gallons per day X cost of plates per pound x 0.137; or for the example cited above, it is 30 x 1000 x 0.137 x 40=$1,644.00. The power cost is ppm. x volume of water in thousands of gallons X 1.11 x the power cost per kwh. For the conditions assumed above, this totals $333, giving a final total for Alhydro of $1,977. The comparative costs do not cover the handling of materials, labor for operation, and similar factors.

Auxiliary Water Supplies Needed in Westchester

NEW YORK CITY uses about 1,185 mgd of water, practically all of which reaches the city from the north through the Catskill, Delaware, New Croton and Old Croton aqueducts and the 48" Bronx pipe line. All of these cross some part of Westchester County, and 25 communities located near them use them as a sole or partial source of supply, purchasing the water from New York City. In fact, of the 592,362 citizens of Westchester County, some 290,000 consume about 22 mgd drawn from New York City's supply.

The city would like to abandon the Old Croton aqueduct and the Bronx pipe line, 106 and 62 years old, respectively, which are no longer of service to it and are expensive to maintain. There is some question as to the rights and obligations of the city on the one hand and of the eight communities served by them, on the other hand. The city probably would not take any such action without previous arrangement with or by the affected consumers.

More imminent to the latter is a shut-down of one or more of these aqueducts made necessary for repairs or maintenance considerations. Water works officials of the city have stated that they contemplate shutting down a section of the Catskill aqueduct for 24 to 36 hours some time this spring for inspection and repairs; and for a much longer period when the Delaware aqueduct has been completed. The Catskill aqueduct has been in continuous service for 32 years, and need of cleaning, inspection and possibly some repairs would normally be expected.

In view of this condition, the Westchester Water Works Conference (composed of water works officials of practically every major water department in the county), has studied and recently reported upon the effect of such shut-downs upon those who use New York's aqueduct as a source of supply. They report that, if the Catskill aqueduct should be shut down, one user would be seriously affected

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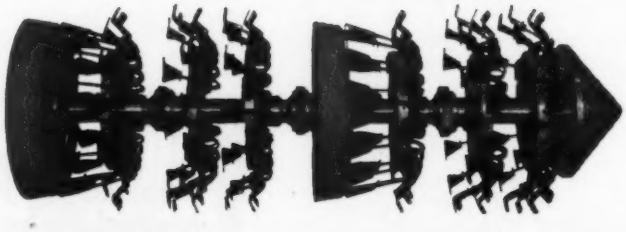
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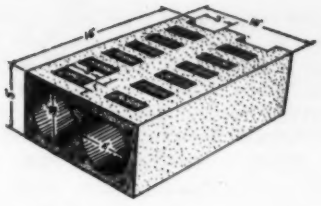

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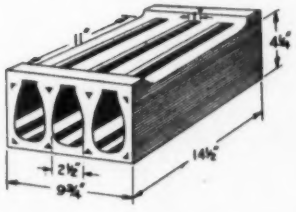

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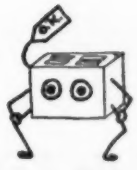

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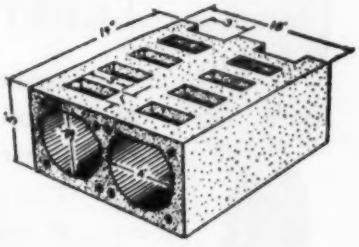

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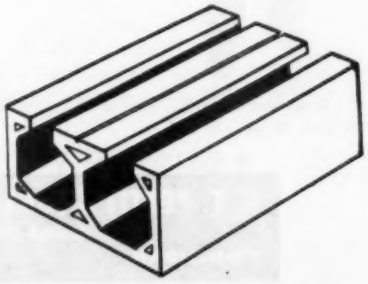

Mono-unit type Metro filter floor system

When you need special information—consult the READERS' SERVICE DEPT. on pages 77-81

if this lasted more than 24 hrs., another if more than 36 hrs., two if more than 48 hrs., and one if more than 72 hrs., since they have no other source of supply. Shutting down the Old Croton aqueduct would be serious to one user if over 24 hrs., to another if over 5 days. Shutting down the Bronx pipe line more than 48 hrs. would be a serious matter for two communities. The committee warns that these various users should give immediate consideration to the acquisition of auxiliary sources of supply.

Operating Imhoff Tanks*

EFFECTIVE operation of an Imhoff tank requires the following regular attention:

A. *At the influent End.*—1. *Clean bar screen or basket daily.* (Some tanks do not have a screen.) Dispose of screenings by burial or burning. Putting the screenings into the gas vents adds to the load on the tank and is poor practice.

B. *Settling Tank.*—1. *Skim off non-organic floating objects.* Do this a few times a week, or as often as necessary to prevent the formation of a continuous scum layer. It is most practical to dispose of these skimmings with the screenings rather than to throw them into the gas vents.

2. *Squeegee sloping walls in settling tank.*—Best to do this weekly. Purpose of squeegeeing is to force all decomposable particles to the slot and into the digestion chamber. In a well-built tank having smoothly finished, shaply sloping walls, only a small amount of the settleable particles will cling to the sloping walls. However, a film will form and this needs to be removed from time to time.

3. *Clear the slot by dragging a short piece of chain on the end of a pole through it.* The chain should be worked through the slot from end to end, using a sawing action. It is necessary to keep the slot clear at all times; to have it clogged will simply turn the settling compartment into a small, undersized septic tank and prevents this part of the Imhoff tank from performing any useful treatment.

C. *Gas Vents.*—1 *Remove floating scum.* This scum ordinarily is digestible and will digest if it can be made to settle. Best method is to poke scum downward with a rod, or to bring about submergence by playing a nose stream on the scum surface. *Do not allow several inches of scum to accumulate;* to do so necessitates skimming it off and then disposing of it by burning or burial.

*From an article in the Official Bulletin of the North Dakota Water & Sewage Works Conference by Wm. N. Gahr, Senior Sanitary Engineer, North Dakota State Dept. of Health.
The accompanying sketch shows hand tools used in tank operation.

Disaster and Epidemic Aid Available

The Communicable Disease Center of the Public Health Service at Atlanta, Ga., has been designated as the disaster and epidemic branch of that service. It will supplement the activities of the American Red Cross, which usually confines its efforts to providing food, shelter and emergency care. The CDC will be available for aid in disease epidemics, floods, hurricanes, tornadoes, fires, earthquakes and explosions. Its activities will include furnishing of equipment and personnel for water chlorination and filtration; sewage

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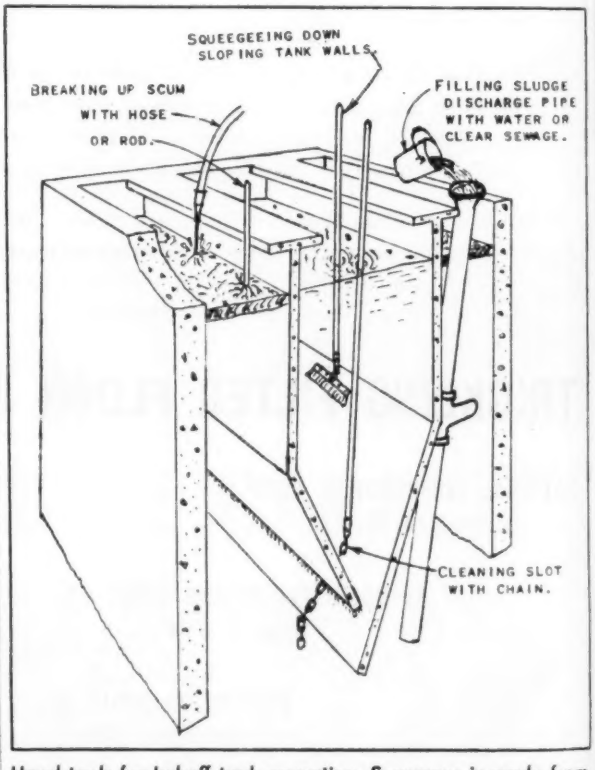
SQUEEGEEING DOWN SLOPING TANK WALLS.
BREAKING UP SCUM WITH HOSE OR ROD.
FILLING SLUDGE DISCHARGE PIPE WITH WATER OR CLEAR SEWAGE.
CLEANING SLOT WITH CHAIN.

Hand tools for Imhoff tank operation. Squeegee is made from 1¼" round wood handle, 3/16" iron "T" and 3" x 12" belting. Slot cleaner is 3 ft. length of ½" 8 link per ft. chain shackled to 1¼" round wood handle.

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chlorination; restoration of garbage collection and insecticide treatment until such systems are restored; control of insects affecting health; and supplementing or furnishing local health organizations.

Mobile equipment and emergency supplies will be located throughout the country, at selected places. These will include trucks and trailers equipped with water purification units, both filtration and chlorination; and insect control equipment. Personnel to operate this equipment will be furnished if necessary. Requests must be made through the State Health Department, and can be telephoned to any District Office of the Public Health Service or to the Communicable Disease Center, Atlanta, Ga., Cypress 1681.

Method of Fixing Municipal Water Works Rates

IN fixing reasonable rates to be charged by a municipal water plant, reproduction costs, like historic costs, are regarded by the New Jersey courts, as a relevant fact requiring consideration, but it is not a conclusive test; the weight to be given to each of these factors is to be determined in the light of the facts of the particular case under consideration. Sustaining the validity of an ordinance fixing water rates for the City of Bridgeton, N. J., the New Jersey Supreme Court, P. J. Ritter Co. v. Mayor of Bridgeton, 50 A. 2d 1, approved the method of the city in calculating the value of its property, used and useful, at the time it was used in the service of the public on the basis of original costs; giving, however, due regard to the honesty and prudence of its capital investment. This method is held free from challenge at the present time, in view of existing industrial and economic conditions, and the scarcity and marked increase in the costs of materials, equipment, supplies and labor.

Snow Removal for All Sidewalks by City?

By JOHN HUBEL

A proposal has been presented to the Milwaukee, Wisc., Common Council that the city remove the snow from all sidewalks within the city limits and charge property owners $2 each as an annual service charge. The Commissioner of Public Works, Walter M. Swietlik, has been asked by the council to furnish an estimate as to the total number of tractor plows that would be required if such snow removal service were furnished throughout the city. Milwaukee has a large number of tractor plows, for the removal of snow on property on which there are no houses or other buildings, the cost being charged to the lot owners. For this purpose the same tractor plows are used that remove the snow from streets and from walks on city owned property. An estimate is being prepared to determine how much profit, if any, would result from a $2 charge for universal snow removal from sidewalks in the city.

Another point that has come up in the common council is the substitution of tractor plows for clearing street intersections, for most of which manual labor is now used at considerably higher expense. Some horse drawn plows are also being used for the purpose.

As snow removal time is at least three months away, even if early snowfall were to come this year, the matter will be given consideration when the common council has time to get around to it.

Blaw-Knox Acquires Foote Co.

With the acquisition of the Foote Co. of Nunda, N.Y., Blaw-Knox now produces a very complete line of road-paving equipment. Foote manufactures concrete paving mixers, black-top pavers, and bituminous mixers, while Blaw-Knox makes bins and batchers, truckmixers, finishers, spreaders, subgraders, steel forms, clamshell and concrete buckets and other items.

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PUBLIC WORKS Equipment News

For Better Garbage Collection—A Better Carrying Can

In collecting garbage, it is customary to empty the contents of householders' cans into a carrying can to reduce the number of trips from the point of collection to the collection vehicle. The carrying cans described here are designed to be easier on the collectors—an important point in these days of labor scarcity—and to last longer.

These cans have a 16-gauge bottom and a 20-gauge side made from "Yoloy" steel. All seams are welded. The band around the top protects the top edge from hard bumps. Reinforcing plates under the handles prevent these from tearing out. The bottom can be made with round edge or square edge, as desired. Cans are made in 16, 20 and 24-gal. capacity.

These cans are easier on the workmen, are claimed to last longer, and are lighter—only 22 lbs. for the 24-gal. can. For more information, write *W. T. Pettit & Sons Co., Inc., 129 South Center St., Youngstown, Ohio.*

The Pettit garbage can is easy to carry.

For Compacting Soils and Aggregates

This machine will compact soils and aggregates, and gives very noticeable increase in density of soils at depths of 3 ft. and more. By changing tire pressures and load weighing, any desired degree or type of compaction is obtained; and by means of a vibrator, 3% to 10% additional compaction is obtainable. Its use permits spreading lifts in much greater depths. Two sizes are available—60,000 and 25,000 lbs. The compactor is towed by either track or rubber-tire tractors at speeds of 1 to 2½ mph. *Iowa Mfg. Co., Cedar Rapids, Iowa.*

New Type Traffic Paint

This "Oncrete" paint is said to be as well adapted for brick or bituminous surfaces as for concrete. It dries in 5 mins. at 75°; available in yellow, white and black, regularly, but other colors can be developed. Used for all kinds of traffic markings. *Lowebco, Inc., 1525 East 53rd St., Chicago 15, Ill.*

Installing Floor and Surface Armors

Floorsteel is a flexible floor armor that unrolls like a rug and is particularly useful over ramps or uneven surfaces. It comes in rolls 25 ft. long and 4′ to 6′ wide. Hexteel comes in standard strips 3′ by 10′, with provision for fastening together. An instruction manual tells exactly how to lay either of these over old surfaces or wooden floors; also describes recommended fills for the openings in the steel. *William F. Klemp Co., Chicago 38, Ill.*

Valve With Hard Rubber Lining

These "straight-through" valves are lined with hard rubber to prevent corrosion, and are proof against almost all known acid and alkaline solutions. The valves are available up to 4″ size, for pressures up to 150 lbs. They are flanged and faced. Larger sizes can be obtained on special order. *American Hard Rubber Co., 11 Mercer St., New York 13, N.Y.*

Dirt-Moving Equipment for Wheel Tractors

For use with the Model UTI Minneapolis-Moline or the LA1 Case wheel tractor, the *Henry Mfg. Co., Topeka, Kans.*, has developed a 2-wheel, rear-dump hydraulic scraper with a capacity of 3 cu. yds. An hydraulic bulldozer has also been announced, as well as a still different type of inside pushbeam bulldozer, which has a special application for digging ditches and pits. A feature of the rear-dump scraper is its ability to bulldoze the material backward after dumping.

Self-Propelled Traffic Line Marker

This traffic line marker is self-propelled, for long or short runs, and for 1, 2 or 3 lines. It is one-man operated. It is mounted on an IHC Off-set Cub tractor, with air compressor driven from power take-off. Two colors of paint can be used at the same time. Two 15-gal. tanks hold the paint; and a box will hold 200 pounds of reflector beads. After initial mounting, the marker can be removed from the tractor in 30 minutes, leaving it free for other uses; and replaced in 30 mins. also. A smaller (M-6) marker, not self-propelled, is also available. *Butler Industries, Inc., Detroit 11, Mich.*

Bituminous Mixing Plant

This is a portable continuous volumetric-type bituminous mixing plant with a capacity of 100 to 150 tons per hour. It can also be set up as a permanent plant. The mixing unit is a pugmill; all operating controls are readily accessible from the operator's platform. *Iowa Mfg. Co., Cedar Rapids, Iowa.*

Impactor-Roller Helps in Maintenance and Patching

This impactor hits 1750 to 2000 blows of 717 pounds each per minute on a strip 25″ wide. This "super-tamping" is claimed to give bituminous and patch materials a density greater than that obtained with a heavy roller. It can finish flush to the curbs, manholes, or edges. The impactor and finishing shoe is heated by the engine exhaust. Weight is 230 pounds. It is easily operated by one man. Write *Wayer Impactor Co., 12 N Third St., Columbus 15, Ohio.*

The Wayer impactor is most helpful on small paving jobs.

Rotary, Leveling and Drag Scrapers

Jumbo Steel Products Co., Azusa, Calif., manufacture rotary wheel scrapers of 22 to 75-cu. ft. capacity for use with 15 to 75 hp. tractors. The leveler-scrapers are 6, 7, 8, 12 and 14 ft.; these have adjustments to insure level cut and spread at all times. The drag scrapers handle from 12 to 22 cu. ft. and require tractors from 10 to 30 hp.

Power Driven Staging for High Work

For painting and repairing bridges, stacks, high buildings, and similar work, these units almost take the place of sky-hooks. An aluminum alloy stage is operated by a small power unit, permitting surprising time savings and the elimination of scaffolding, staging, etc. For interesting information, write *Spider Staging, Inc., Renton, Wash.*

Inside Mounted Dozer for Heavy Work

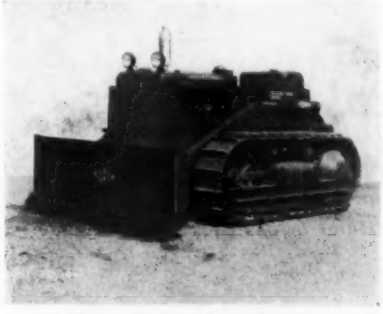
A new-type inside mounted dozer, for use with IHC TD14W and 18W tractors, is designed for rough and heavy work. This unit has a very high lift—48", which gives extra leverage in clearing trees. Blade can be dropped 12 ins. below ground. Width is under 8 ft., making highway transportation permits unnecessary. *American Tractor Equipment Co., 9131 San Leandro Blvd., Oakland 3, Calif.*

A Better Concrete Bucket

This is a new, round-type concrete bucket for use with a crane where the concrete must be elevated or where forms cover a considerable area. Bucket capacity is 27 cu. ft. Grout will not leak out. Write *Muller Machinery Co., Metuchen, N.J.*

A Half-Bag Concrete Mixer

This is a handy small concrete mixing unit that will be very useful for minor repairs and replacements of sidewalks, curbs, pavements and driveways, and can be used for mixing small amounts of concrete for the numerous small jobs involved in water works, street work, etc.; 3 hp. engine; rubber tires. *Vanco Products, Inc., 130 S. Weber St., Colorado Springs, Colo.*

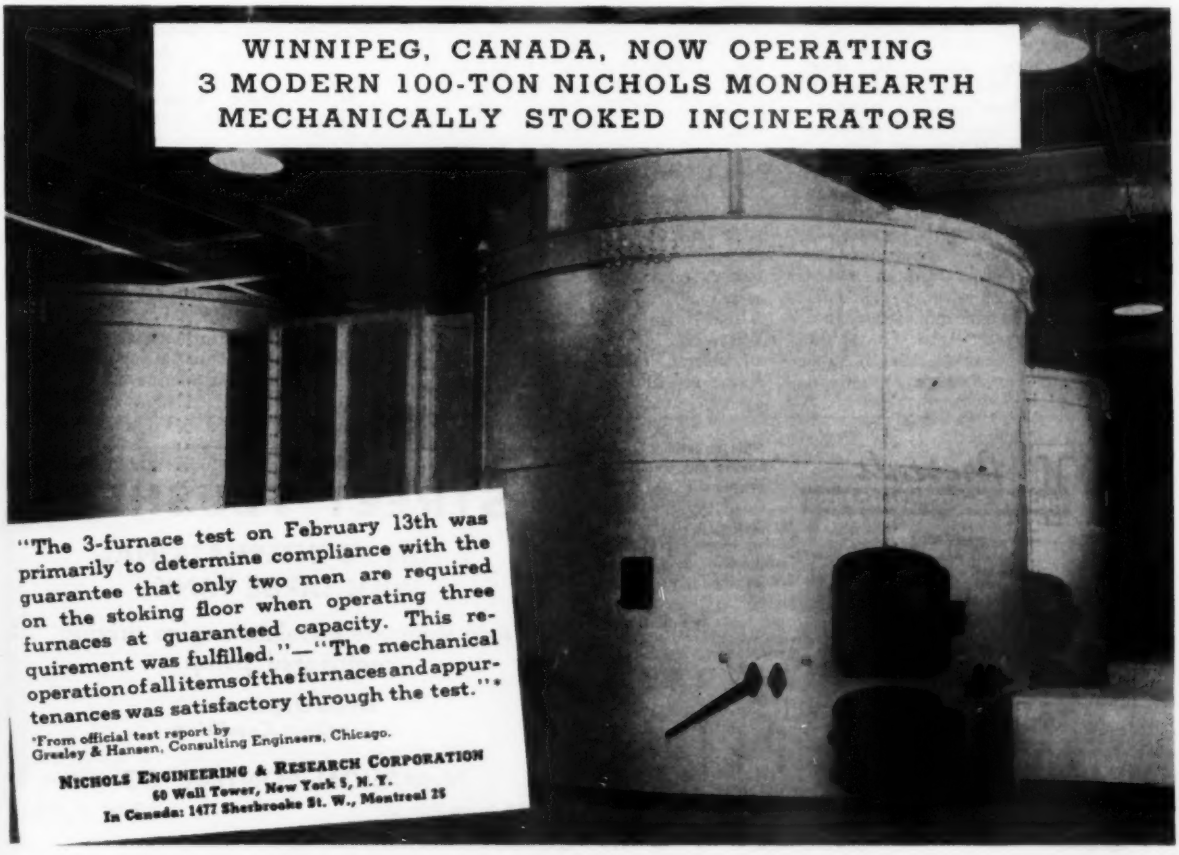


Ateco heavy duty dozer.

Muller concrete bucket.

A 7-ton Capacity Motorized Crane

This crane does not need outriggers or counterweights, and can carry its load—if movement is necessary—at speeds up to 28 mph. on rough or smooth terrain. Turning radius is 20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In Canada: 1477 Sherbrooke St. W., Montreal 25

ft. Maximum lift 29′ 6″. The capacity is 7 tons and the unit is the EC-7 Tournacrane. *R. G. LeTourneau, Inc., Longview, Tex.*

Grade Crossing Safety and What to Do About It

This is a new 24-page booklet, well illustrated, which not only gives a history of the evolution of grade crossing protection, but lists the ten common causes of grade crossing accidents and illustrates them. It contains an article by A. A. Benesch, consulting engineer, in which the various methods of protecting crossings are discussed, including grade separations and modern protective devices, with the costs and advantages of each. This booklet should be of particular interest to city and county engineers, for a recent survey among county engineers has shown that there are about 60 dangerous crossings in need of protection in every 100 counties. The booklet will be sent on request to Western Railroad Supply Co., Chicago 8, Ill.

Nylon Coated Wire Rope

Called "wirelon," this nylon coated rope is available in diameters from 1/32 to 1-inch, and can be used for all sorts of work. It appears to lengthen the life and increase the usefulness of such rope in many types of service. The coating is not affected by oils, marine growths, alkalis or acids; and the ropes retain their flexibility whether wet or dry. Write *Rochester Ropes, Inc., Culpeper, Va.*, for further data.

New Technical Booklets and Catalogs

Get yours today by writing manufacturer or use coupon on page 77

Front End Loader.—Two 4-page booklets describe and give full specifications on the front end loaders manufactured by Ottawa Steel Products, Inc., Ottawa, Kans. These are made for both the International and Case wheel tractors, and can be used with bulldozer blade, 7′ scraper blade, 60″ snow bucket, extension boom and level loader.

Contractors Pumps.—This complete booklet lists and describes self-priming centrifugal pumps, 4,500 gals. per hr. to 90,000 gph. Also contains engineering data, including friction of water in pipes, conversion factors, etc. Ralph B. Carter Co., Hackensack, N.J.

Counting Traffic.—Instructions for Traficounters are contained in a 16-page booklet. Where to set, how to start a test count, operation and maintenance are covered. Streeter-Amet Co., 4101 N. Ravenswood, Chicago 13, Ill.

Sand Filter for Sewage Treatment.—A new 4-page folder describing the automatic backwash rapid sand filter and its application to sewage treatment. Hardinge Co., 240 Arch St., York, Pa.

Hoists.—Jaeger 2-speed hydro-hoists and their application, including engineering data on loads, horsepower, line pull, line speed, breaking strength of cables, etc., are described in two booklets. HU-8 for 25-40 hp. hoists, 12 pps.; and HE-8, 60 to 100 hp., 16 pps. Jaeger Machine Co., Columbus 16, Ohio.

Selecting Electric Motors.—A 12-page bulletin with specifications, application data, speed and size ranges and motor selection chart, with range of each type of control by voltage and hp. Allis-Chalmers Mfg. Co., Milwaukee 1, Wisc.

Power Graders.—With complete specifications, and with illustrations of attachments, such as power sweeper, scarifier, snow plow, leaning wheels and extra size tires, this bulletin describes the new M-B power grader. Meili-Blumberg Corp., New Holstein, Wisc.

Drafting Timesavers.—A new 4-page booklet of layouts for engineers, designers, draftsmen and architects, showing many kinds of useful templates. Rapidesign, Inc., Box 592, Glendale, Calif.

4-Cycle Engines.—A leaflet and a folder describing 4-cycle engines, with cut-away views and much other data. Lauson Co., New Holstein, Wisc.

Coatings. — Resistant linings and coatings for water, sewerage and other places where corrosion is a problem. A 30-page booklet with lots of information. Heresite & Chemical Co., Manitowoc, Wisc.

Snow Plows.—Plows for industrial wheel tractors, one way blades, reversible blades, V truck plows, with and without wings, grader plows and wings and jeep plows are described in this 36-page booklet. Wausau Iron Works, Wausau, Wisc.

Spreaders. — For ice control, seal coating and other highway work; one-man operated. Sand spreaders and aggregate spreaders. Hydro Spreader Corp., 247 Madison St., Waukesha, Wisc.

Automatic Controls.—Bulletin 2050 describes a new line of closed tank float switches, also available for open tank installations. Automatic Control Co., St. Paul 4, Minn.

Scrubber and Cooler.—Devices to remove impurities from gases by passage through a spray. Peabody Eng. Corp., 580 Fifth Ave., New York 19, N. Y.

Diesel Engines.—Two booklets by Caterpillar Tractor Co., Peoria, Ill.: "Diesel Engines and the Work They Do" and "The Power for Crushing and Screening Plants."

Sewage Treatment. — The Aero-Filter system, 16 pages of excellent data on this type of high rate filter, with design information, performance curves and results at typical plants; rectangular type sludge collectors for

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New Bulletin 221 describes the recent improvements in P.F.T. Gas Safety Equipment; for better protection for boiler rooms and other installations, and longer service life for the equipments.

All units are illustrated with detailed drawings. Specifications, typical gas piping arrangements and charts for selecting sizes are included.

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sewage and water treatment; and pneumatic sewage ejectors, with full data on sizes, how to use, layouts, air volumes, etc. Yeomans Brothers Co., 1425 No. Dayton St., Chicago 22, Ill.

Corrosion-Resistant Alloys.—A new bulletin on Chlorimet, with data on use with acid and salt solution, and charts of corrosion resistance tests. Duriron Co., Inc., Dayton 1, Ohio.

Handy Crane.—A photo sheet illustrates the use of this handy crane in water works construction and maintenance, pipe, valve and hydrant handling, etc. Ruger Equipment Co., Inc., 2425 St. Clair Ave., Cleveland 14, O.

The Dorrco Slaker.—Designed to handle continuous lime slaking plus classification and grit removal, this single, compact unit is described in Bulletin 7281, The Dorr Co., 570 Lexington Ave., N. Y.

Gauges for Water Plants.—Bulletin DI-450 shows some of the gauges necessary for modern water filtration plants, describes them and gives specifications. Builders-Providence, Inc., Providence 1, R. I.

N. Y. State County Highway Superintendents

The New York State CHSA will hold its 1948 summer meeting at Bear Mountain Inn, Bear Mountain, N. Y., on September 7, 8 and 9. Nelson W. Hall, County Superintendent of Highways, New City, N. Y., is Chairman.

Sewage Works Association

The 21st annual meeting of the Federation of Sewage Works Associations will be held at the Hotel Statler, Detroit, Mich., Oct. 18-21. The Michigan Sewage Works Association will act as host.

On the technical program will be the papers by Prof. Rolf Eliassen on "Mechanisms of Hydrogen Sulfide Production"; by Dr. A. E. Berry on "Sewage Treatment and Waste Disposal in Ontario"; by Dr. James B. Lackey on "Biology of Sewage Treatment"; by Daniel A. Okun on "A System of Bio-Precipitation of Organic Matter from Sewage"; and by Dr. Willem Rudolfs on "Effect of Synthetic Detergents on Sewage Treatment Processes."

The activated sludge process is the basis for two contributions: "Mathematical Aspects of Bulking Activated Sludge," by Leon S. Kraus, and "Factors Affecting the Efficiency of Activated Sludge Plants," by Prof. William E. Stanley.

One afternoon is to be devoted to an inspection trip of the Detroit and Dearborn sewage treatment plants. Background for the tour will be given in the paper "Design and Operation of the Detroit Sewage Treatment Plant," by W. M. Wallace. Of further significance as to conditions in the Detroit area will be the report by M. Le Bosquet, Jr., on the "USPHS Survey of the Detroit River."

Discussions on industrial waste problems include: "The Problem of Waste Disposal from Atomic Energy Operations," by Arthur E. Gorman; "Industrial Wastes Forum," to which an entire session is assigned with papers as follows: "Dye Plant Wastes and Disposal in Streams," by Dr. V. L. King; "Dairy Waste Disposal," by Prof. E. F. Eldridge; "Waste from Chemical Manufacturing," by Dr. R. W. Hess; and "Indices of Stream Pollution," by Prof. Don E. Bloodgood.

Practical aspects of sewage works operation and maintenance will be given a good share of attention in the paper "Sewer System Operation and Maintenance Procedures at Milwaukee," by Lloyd D. Knapp, and in the "Operators' Forum," which is given a full session. The forum, always a highlight of the program, will be conducted by Ralph E. Fuhrman.

Arizona Sewage and Water Works

The fall conference of this association will be held Oct. 15-17, 1948, at Hotel Westward Ho, Phoenix, Ariz. Mrs. Helen Rotthaus, Sanitary Engineering Division, State Capitol, Phoenix, Ariz., is secretary-treasurer.

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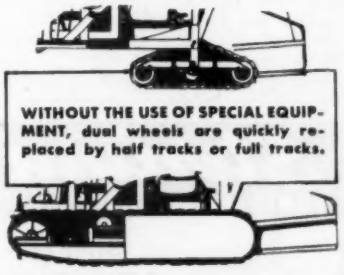

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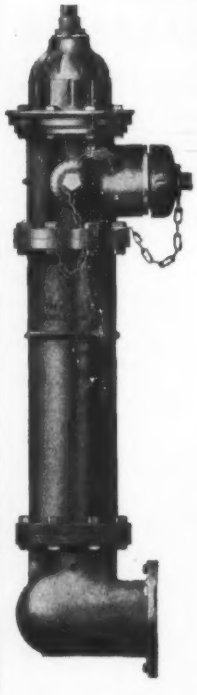

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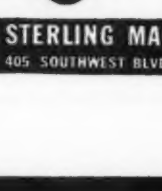

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10. Before you buy another pump you will want this beautiful new brochure No. 4053 illustrated and with useful data and operating hints. Issued by Ralph B. Carter Co., Hackensack, N. J. Shows full-line of Humdinger Pumps. Address Carter direct or use our coupon.

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66. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

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76. Two models of pressure distributors give uniform pressure and temperature, positive start and shutoff, accurate displacement pumping. Also SJ distributor for maintenance work. Bulletins RS 6145 and RS 12046V. Standard Steel Works, North Kansas City, Mo.

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Streamline Sludge Collectors

79. Latest bulletin on Yeomans Streamline Sludge Collectors and Sludge Hoppers illustrate primary and secondary tank types, give design details and specifications. Yeomans Brothers Co., 1425 No. Dayton St., Chicago 22, Ill.

Get This on Water Mains

80. is the number to circle on the coupon and we will have the Cast Iron Pipe Research Assn. send you their new booklet giving detailed report on cast iron pipe water main system surveys. Or address Cast Iron Pipe Research Assn., Thomas F. Wolfe, Engineer, Dept. P, 122 S. Michigan Ave., Chicago 3, Ill.

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82. Here is a complete, illustrated treatise on the Halverson-Smith process for sewage and waste treatment. Gives valuable Aero-Filter design information with expected performance data. 16 pages of helpful information. Write Yeomans Brothers Co., 1425 No. Dayton St., Chicago 22, Ill.

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Please send me the following literature listed in the Readers' Service Dept. of your August issue. (Circle catalogs that you need.)

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22	24	27	28	33	35	36	37	38	39	41	42	43	44	45
48	49	50	51	52	53	55	56	58	59	60	62	63	64	66
67	70	71	72	74	75	76	77	78	79	80	81	82		

Others_____

Name_____

Occupation_____

Street_____

City_____ State_____

THIS COUPON NOT GOOD AFTER SEPTEMBER 30th

Data Book on Universal Concrete Cribbing

21. Shows typical sections for designing walls, pictures many applications, specifications, etc. Get the facts today about this economical reinforced concrete cribbing. Universal Concrete Pipe Co., Dept. PW, 297 So. High St., Columbus 15, Ohio.

Strong, Speedy, Low-Cost Maintainer Has Many Uses

22. BG Maintainer, a powerful speedy, low-priced machine for light road maintenance. Full details in illustrated folder. Huber Mfg. Co., Dept. PW., Marion, Ohio.

Useful Attachments For Your Industrial Tractor

24. Need a front end bucket loader that can be converted into a light plow or grader in a matter of minutes? Write for this folder that illustrates, describes and gives specifications of the Ottawa Industrial Front End Loader for industrial tractors. Loads earth, sand, gravel and other bulk material. Quick change over can be made to light bulldozer, V-type snow plow, grader or maintainer with attachments. Write Dept. PW, Ottawa Steel Products, Inc., Ottawa, Kans.

Diesel Engines to Help You Build Profits

27. A new 28 page catalog just off the press titled "Superior Stationary Diesel Engines," is packed with facts that will help you build profits. For your copy write to Superior Engine Division, National Supply Company, Springfield, Ohio.

Solve Your Drainage Problems This Easy, Permanent Way

28. Useful new 60 page catalog on standard corrugated pipe, multi-plate pipe and arches and 18 other drainage and related products for culverts, sewers, subdrains, flood control, airports, water supply and other types of construction. Ask for "Armco Products for Engineering Construction," Armco Drainage and Metal Products, Inc., Dept. PW, Middletown, Ohio.

Open Steel Mesh Pavement for Bridges

72. A pavement that is self-cleaning, self-draining, light of weight, strong, durable, fireproof, economical and requires no maintenance, is described in a 24-page catalog by Irving Subway Grating Co., 5053 27th St., Long Island City 1, N. Y.

SEWAGE DISPOSAL

Equipment for Treating Sewage, Water and Trade Wastes

20. A well prepared 44 page illustrated booklet on use and advantages of Floctrols, Traveling Water Screens, Triturators, Sludge Collectors, Sludge Removers, Grit Collectors and Bar Screens made under the name of "Rex" for use in Trade Wastes, Sewage and Water Treatment by Chain Belt Company, 1722 West Bruce St., Milwaukee 4, Wisc. Contains a page of useful Conversion Factors.

Non-Corrosive, Long Lasting Low Cost of Sewer Pipe

33. Get this new engineering data on clay pipe for sewers. Withstands acid, alkali and gas attacks indefinitely. Cuts maintenance costs to a minimum. Write Dept. P.W., National Clay Pipe Mfrs., 111 W. Washington St., Chicago 2, Ill.

Save Trucks and Labor In City Rubbish Collection

35. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Brothers, Inc., 996 Higgins, Knoxville 17, Tenn.

Packaged Sewage Treatment— Just Right for Small Places

36. "Packaged" Sewage Treatment Plants specifically developed for small communities — 100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Dept. P.W., Adams, Mass.

Do Your Water Mains Need Cleaning?

38. Literature on Flexible method of cleaning water mains any size from 2" to 72", giving full details and list of nearest representatives in all parts of country. Address: Flexible Underground Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

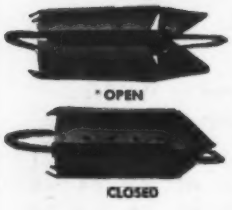
Need Low-Cost Air For Sewage Treatment?

39. New booklet on Centrifugal and Rotary Positive Blowers engineered to fit your needs: air for activated sludge; constant vacuum for filters; priming centrifugal pumps; measuring sludge gas; water treatment. Write Roots-Connersville Blower Corp., 712 Poplar Ave., Connersville, Ind.

Solve Corrosion Problems With This Special Alloy

41. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. Dept. P.W., the American Brass Co., 25 Broadway, N. Y. C.

KEEP SEWERS OPEN
with
OK CHAMPION
POWER SEWER CLEANER



Town and City officials throughout America are adopting OK CHAMPION Power Sewer Cleaner to keep sewers clean and efficient. Takes roots, dirt, sand, and other debris up from main in one continuous operation. All men work above street level.

Pulling forward opens the jaws that bite into obstructions. Reversing the pull on the bucket automatically closes jaws which hold load pulled back to street level. Write for complete details.

CHAMPION CORPORATION 4716 SHEFFIELD HAMMOND, IND.

The Sensational New
FEATHERWEIGHT
MODEL 87
GOLDAK
PIPE LOCATOR

Goldak Invites Comparison

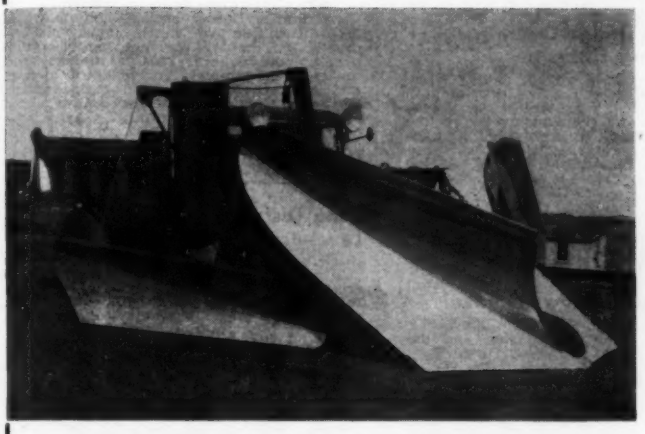
- Shows - not approximate but *EXACT* location of buried pipes, mains, services, gates, tees, ells, stubs, etc.
- Completely new electronic circuit provides an incomparably strong positive location signal.
- No trick tubes or other hard-to-get parts. Uses readily available standard miniature radio tubes and flashlight batteries.
- Compact in design, ruggedly built for lifetime use.
- Operating simplicity. A one-man instrument.
- Featherweight - only 11 lbs. complete.
- Guaranteed superior performance - resulting from 15 years of electronic research and construction of locating instruments.

GOLDAK *OUTSELLS* - BECAUSE IT *EXCELS*

WRITE FOR DETAILS
THE GOLDAK COMPANY
1544 West Glenoaks Blvd., Glendale 1 California

When you need special information—consult the READERS' SERVICE DEPT. *on pages 77-81*

GIVE US THE TIME—



FRINK V TYPE FOR HEAVY DUTY SNOW REMOVAL

AND WE WILL GIVE YOU THE

FRINK

SNO-PLOWS

☆

AN EXPLANATION

This is an explanation . . . and a frank appeal for your cooperation. Considering the current over-demand for steel, Frink is making a lot of Sno-Plows every day. But orders continue to exceed our capacity.

If you are experiencing delays in our filling of your orders, please be assured: (1) That we are doing everything possible to take care of you. (Naturally old customers come first, but we have never lost our desire to add new ones where we can.) (2) That the quality of Frink Sno-Plows remains unaffected by these conditions.

HOW YOU CAN HELP

Give us all the time you can by anticipating your needs and placing your orders for Sno-Plows as far ahead as possible. If you can make your present plows last longer, it will help both us and your neighbor who may need his Frink Sno-Plows even worse than you do. By doing this you can be assured of the best possible shipping time by us on your current and future orders.

JUST A REMINDER

Regardless of your plowing problems, the famed Frink "V" type Sno-Plows are tailor-made to snow conditions in your area. You have 11 different models to select from . . . and when you purchase a Frink you are confident that you are getting the very best in design and workmanship.

Frink Sno-Plows are self-ballasting, and are available with or without side-leveling wings, and full power hydraulic control. Streets, highways, airports are thoroughly cleaned, quickly and economically.

For the latest developments of snow removal and for data in selecting the proper size plows: Write Box PW, Clayton, New York.

FRINK SNO-PLOWS

REG U S PAT OFF

FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK
DAVENPORT-BESLER CORP., DAVENPORT, IOWA
FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.

When writing, we will appreciate your mentioning PUBLIC WORKS

THE NAMEPLATE OF DEPENDABILITY

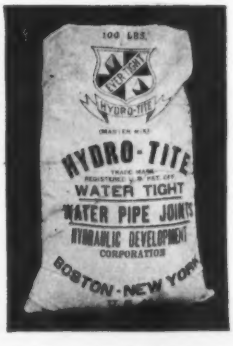
WATER FILTRATION PLANTS AND EQUIPMENT • ZEOLITE SOFTENERS WHEELER FALSE FILTER BOTTOMS PRESSURE FILTERS • SPECIAL WATER TREATMENT EQUIPMENT

The plus values that come with Roberts Filter equipment are intangibles of long experience, engineering skill and the ability to work with others.

We invite the opportunity to cooperate with individuals and organizations interested in the correction of water, either for municipal or industrial requirements. Your request will bring full information on the application of our products and services.

ROBERTS FILTER MANUFACTURING CO.
640 COLUMBIA AVE., DARBY, PA.

HYDRO-TITE



TESTED FOR OVER 30 YEARS

For more than thirty years water works superintendents have been using Hydro-tite for joining bell and spigot pipe. They have found that this self-caulking, self-sealing compound costs less to buy, requires less labor, makes tighter joints and withstands the effects of time, strain and vibration. Send for data book and sample.

ALWAYS USE FIBREX, the bacteria-free packing for pipe joints. Send for sample.

HYDRAULIC DEVELOPMENT CORPORATION
Main Sales Office: 50 Church St., New York, N.Y.

Design Details for Sludge Collectors

42. Booklet No. P.W. 1642 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, illustration pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

Ask for This Design Data On Sprinkling Filters

43. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., Dept. P.W., 4241 Ravenswood Ave., Chicago 13, Ill.

SNOW FIGHTING

For High-Speed Snow Removal

44. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow, Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

STREETS AND HIGHWAYS

Road Protection at Less Cost

16. There's no limit to the jobs you can handle with an Allis-Chalmers Package outfit consisting of the HD-5 Tractor with Tracto-Shovel and Model A-D Motor Grader. For booklets describing and illustrating these and other Allis-Chalmers Equipment write Dept. PW, Allis-Chalmers Tractor Division, Milwaukee 1, Wisc.

Here's Your Diesel Tractor!

50. Big 48 page catalog describes and lists many uses for International Diesel Tractors. Write International Harvester Co., Dept. P.W., 180 North Michigan Ave., Chicago 1, Ill.

Latest Maintenance Equipment For Blacktop Roads

52. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

WATER WORKS

Long Distance Recording of Level-Pressure-Flow

9. Be sure to get Bulletin 358 on the "Chronoflo Telemeter" that brings accurate records of flow, level, pressure , temperature, gate positions, weight, etc., from widely scattered locations to a central operating point. Widely used in Water and Sewage plants. Write Builders-Providence, Inc., 16 Codding St., Providence 1, R. I.

A New Answer to Some Old Waterworks Problems

12. That is what they call "Hypo-Chlorination of Water," a 75-page illustrated discussion of this live subject, in a booklet packed with helpful information. For your copy, address: Mathieson Chemical Corp., Dept. PW, 60 E. 42nd St., New York 17, N. Y.

All About Cement-Mortar Lining of Water Mains

13. Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—the needs, methods, and results that will interest you. Centriline Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

All of These Booklets Are FREE, and Many Are of Great Value. To Order Those You Need in Your Work Use the Coupon on Page 77.

Protect Your Grade Crossings With Model 10 Signals

45. Bulletin G17-PW6 describes and illustrates the automatically operated Model 10 railroad crossing signal. Folder describing this signal which guards against "second train" accidents and permits fast flow of rail and highway traffic is available on request from Western Railroad Supply Co., 2406-2436 South Ashland Ave., Chicago 8, Ill.

Speed Your Work With These Powerful Motor Graders

48. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

Practical Portable Power Units for Every Need

49. M-M power units with heavy duty engine, positive lubrication, easy servicing, handy controls may be just what you have been looking for. Simple, durable, practical. Get latest bulletin from Dept. P.W., Minneapolis Moline Power Implement Co., Minneapolis 1, Minn.

Need Street, Sewer or Water Castings?

51. Street, sewer and water castings in various styles, sizes and weights. Manhole covers and steps, inlets and gratings, adjustable curb inlets, water meter covers, cistern and coal hole covers, gutter crossing plates, valve and lamphole covers, etc. Described in catalog PW issued by South Bend Foundry Co., South Bend 23, Ind.

How Elevated Water Tanks Can Save on Operating Costs

14. Beautiful new booklet on Horton elevated steel water tanks suggests ways to reduce pumping costs, increase capacity of systems, maintain uniform pressure, etc. Illustrates 7 models of welded, ellipsoidal-bottom, elevated steel tanks in full color. Write Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4.

The Modern Way to Filter Swimming Pool Water

17. That's the title of a new bulletin full of facts about Bowser's new diatomite filter to produce clear, sparkling, clean water at low cost. Occupies small space, doesn't waste water. Gives sizes to use, performance charts, etc. Write Bowser, Inc., Dept. PW, Ft. Wayne, Ind.

Eliminate Taste and Odor From Your Water

53. Technical pub. No. P.W. 213 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination. Send free to any operator requesting it.

Here's Data on All Swimming Pool Needs

55. Well illustrated bulletin describes Filters, Water Softeners, Hydrogen Ion Plants and Complete Equipment for Swimming pools, etc. Copy sent on request by Dept. PW., Chemical Equipment Co., 223 Center Street, Los Angeles 54, Calif.

USE COUPON ON PAGE 77 TODAY TO ORDER THE LITERATURE YOU NEED.

Have You a Water Conditioning Problem?

56. Installation-tested equipment for complete municipal and industrial systems or individual units. Illustrated and described in latest booklets from Dept. P.W., American Wells Works, Aurora, Ill.

To Measure, Mix, Feed Chlorine or Other Gases

58. Everson SterElators. Bulletins 1063, 1066, 708 and others describe this device for measuring, mixing and feeding chlorine or other gases in solution. Capacities range from ¼ lb. to 2,000 lb. of gas per 24 hours. Address: Everson Manufacturing Co., 214 W. Huron St., Chicago 10, Ill.

Hydraulic Pipeline Scraper For Water and Sewage Mains

59. For a copy of this compact folder on a hydraulic pipeline scraper which cleans all kinds of mains from 4 inches to 14 inches write to Dept. PW, Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Chem-O-Feeders for Automatic Chemical Feeding

60. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation, treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

Find Buried Pipe and Leaks

62. Finding Buried Pipe, Leaks is easy with the new Featherweight Goldak Pipe Locator. An easy-to-read illustrated bulletin tells the full story quickly. Address: The Goldak Co., 1544 W. Glenoaks Blvd., Glenade 1, Calif.

All Kinds of Valves And Hydrants

63. Hydrants and Valves. Catalog P. W. covers fire protection appliances, including hydrants, gates and check valves. Catalog also describes sluice gates, shear gates, and flap, mud, gate, check and foot valves. Address: Mueller Company, Chattanooga, Tenn.

Helpful Data on Hydrants

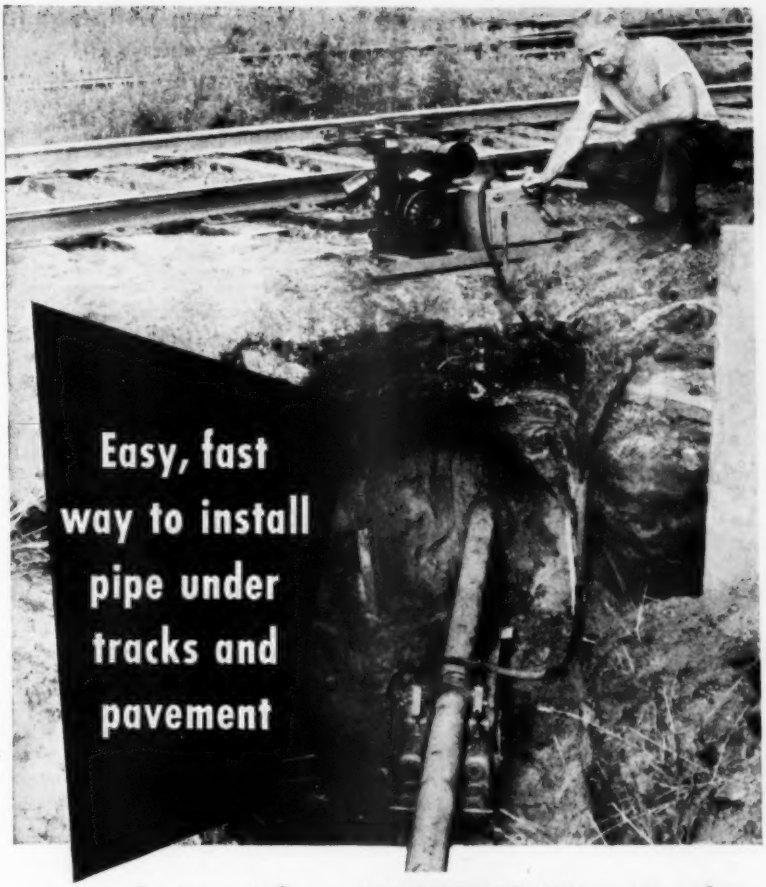
64. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

How to Use Alum For Coagulation

70. Alum for coagulation in both sewage and water plants is the subject of literature now available from Dept. PW, General Chemical Division, 40 Rector St., New York 6, N. Y.

88 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 88 page booklet. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.



...*push it* with a GREENLEE Pipe Pusher

What might be a very tough job—installing pipe under a railway, street, sidewalk or floor—becomes a quick, simple one with a GREENLEE Hydraulic Pipe Pusher and Power Pump.

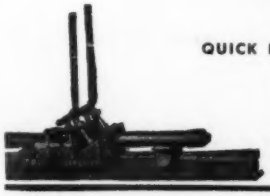
With this GREENLEE equipment *one man* can push pipe at the rate of *two feet a minute*... do in half an hour work that could take several men a day or more using old methods.

The GREENLEE eliminates extensive ditching as just a short trench accommodates the Pusher... no disturbing of roadbed or traffic, no tearing up of pavement, lawns, floors... does away with back-filling, tamping, tunneling, repaving. Cuts job time to a fraction.

Get facts today on this time-saving, efficient tool. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 2048 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE



QUICK FACTS ABOUT THE GREENLEE HYDRAULIC PIPE PUSHER

Easy — one or two men can easily operate on any job. *Portable* — compact, easy to carry to job and set up. *Fast* — operates at six different speeds. *Two models* — (1) for pipe up to 4-inch; (2) for larger pipe, drainage ducts, concrete sewer pipe. Do the job easier, quicker with a GREENLEE.

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-81*

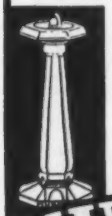
A "PLUS" NAME

Look inside MURDOCK Outdoor Water Service devices to see why they last so long and give so little trouble.

Red Brass Inner Working Parts—

Red Brass Bottom Connection—

Bronze Spring.



And every part so carefully machined as to make like parts interchangeable.

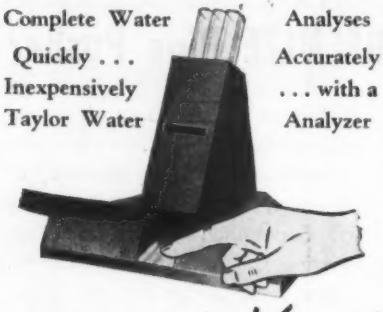
The Murdock Mfg. & Supply Co.

Cincinnati 2, Ohio

MURDOCK

"LOCK-LID" STREET WASHERS ¾" and 1" SIZES
SELF-CLOSING ANTI-FREEZING HYDRANT
ANTI-FREEZING COMPRESSION HYDRANT
LARGE ANTI-FREEZING HYDRANTS 1½" TO 2" INCLUSIVE

Complete Water Analyses Quickly . . . Accurately Inexpensively . . . with a Taylor Water Analyzer



There's the Value!

pH, COLOR, MANGANESE, TOTAL IRON, AMMONIA, CHLORINE, SILICA, NITRATE N, NITRITE N, FLOURIDE

The Taylor Water Analyzer is so inexpensive, and so easy to use, that even the smallest water treatment plants can make complete analyses. Nine Taylor Liquid Color Standards, a complete set for each indicator or determination, are permanently enclosed in one plastic slide, eliminating the expense and handling difficulties of single standards. Moreover, Taylor Color Standards carry an unlimited guarantee against fading. All necessary slides fit the one base.

FREE—INFORMATIVE BOOKLET!

Write direct for "MODERN pH AND CHLORINE CONTROL"—96 pages of valuable data for all men concerned with water purification problems. Illustrates and describes all Taylor sets. See your dealer for equipment.

W. A. TAYLOR AND CO.

7304 YORK RD. • BALTIMORE 4, MD

ADVERTISING INDEX

Now on page 76

JOBS FOR ENGINEERS

Minnesota Department of Health, Public Health Engineering Aide, $214 to $254; Public Health Engineer I, $290 to $340; II, $361 to $421; III, $436 to $496; and IV, $502 to $572. Written examinations are required for the first two positions; ratings for II, III and IV will be based on evaluation of training and experience, and registration as professional engineers will be necessary. Experience requirements increase with ratings. Open to citizens of the U.S., regardless of local residence. Write John W. Jackson, Recruiting and Examining Division, Civil Service Department, St. Paul 1, Minn. Apply at once.

Supervising Engineer, Maintenance and Operations, Division of Architecture, salary range $556 to $676 per month. Requires knowledge of operation, care and maintenance of large plants, plumbing and sewerage systems, hydraulics, water and sewage treatment, electrical installations, etc. Applications must be in by August 28. Write State Personnel Board, 1015 L St., Sacramento, Calif.

Professional engineers, grades P-1 to P-4, all options inclusive, are needed by the Portland District, Corps of Engineers, 628 Pittock Block, Portland 5, Oregon. Salaries range from $2947 to $5232. Also needed are general construction inspectors, and cartographic and structural draftsmen, salaries $2975 to $3351. Write District Engineer at above address.

Sales representatives are wanted for Kansas City and St. Louis by the General Filter Co., 923 Second St., Ames, Iowa, Joseph P. Lawlor. This company manufactures a broad line of water works products.

PERSONAL NEWS

A. A. Kalinske, formerly chief hydraulic engineer for Infilco, Inc., has been made director of Development for that company.

Edmund B. Besselievre has been placed in charge of all foreign sanitary engineering activities of the Dorr Co., with headquarters for the present in New York.

Richard C. Ward and James W. Moore have announced the establishment of the firm of Ward & Moore, consulting engineers, with offices at Corning, N.Y., for general consulting engineering work.

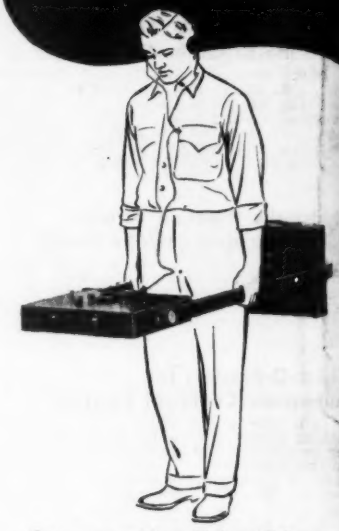
ADVERTISEMENT FOR BIDS

Notice to Bidders:

Sealed bids addresesd to the Mayor and City Council of the City of El Paso, El Paso County, Texas, will be received at the office of the City Clerk, City Hall, El Paso, Texas, until 10:00 A.M. Thursday, August 5, 1948, for construction of 6,750 lineal feet of concrete lined canal in conjunction with Storm Sewer Drainage Project.

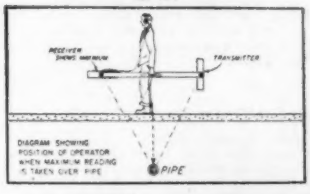
W. R. COLLINS
City Clerk

FISHER M-SCOPE PIPE AND CABLE FINDER



One man with a Fisher M-Scope Pipe and Cable Finder can precisely, *locate, trace,* and determine the depth of a buried pipe or cable line . . . even thru concrete. The M-Scope does the job in a fraction of the time wasted in blind exploratory excavating.

Fisher M-Scope Equipment from $67.50 up



Send for FREE Descriptive Literature

Inquire Dept. 6

Fisher Research Laboratory, Inc.

PALO ALTO • CALIFORNIA

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